Finance Research Letters 31 (2019) 146–154

Contents lists available at ScienceDirect

Finance Research Letters

journal homepage: www.elsevier.com/locate/frl

Asymmetric effect of style comovement on momentum

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ARTICLE INFO

JEL classification:
G10
G11
G14
E32

Keywords:
Style investing
Market states
Style comovement
Momentum
Style chasing

ABSTRACT

This study examines whether the impact of style investing on momentum profits depends on market states. By measuring the style comovement to evaluate the influence of style investing on momentum, our evidence shows that the momentum profits on high style comovement portfolios are higher than on low style comovement portfolios. The momentum strategies on high style comovement portfolios are more profitable when the market is optimistic. Our findings demonstrate that style chasing behavior by investors is reinforced following increased market optimism, thus generating an asymmetric influence of style investing in momentum profits.

1. Introduction

Classification of large numbers of stocks into categories is frequently to help investors allocate funds into categories such as large-cap stocks or value stocks (Bernstein, 1995; Swensen, 2000). Use of such asset categories by investors to allocate funds between investments of different styles is known as "style investing," and there is a growing literature linking style investing with market anomalies. For example, Barberis and Shleifer (2003) argue that assets of the same style have higher comovement, resulting in the momentum effect. Consistent with this notion, Barberis et al. (2005) confirm that style investing generates higher comovement within styles, concluding that this phenomenon can be explained by the sentiment-based view, and not by the fundamentals-based view. Kumar and Lee (2006) further show that individual investors buy and sell stocks in concert, increasing comovement within styles.[1] Therefore, comovement driven by style investing (style comovement) is associated with higher momentum return because it attracts cash flows from investors (Wahal and Yavuz, 2013).

However, the relation between style comovement and momentum profits may depend on market states and thus generate asymmetric momentum profits. The existing literature demonstrates that increased market optimism is associated with higher momentum profits (Cooper et al., 2004; Stambaugh et al., 2012; Antoniou et al., 2013). For example, Cooper et al. (2004) consider the argument of Hong and Stein (1999) that investors' optimism growth is reflected by the decreasing risk aversion and show that the momentum effect is stronger during positive market return states. Brown and Cliff (2005) argue that investor sentiment increases with rising market prices, and this build-up of optimism results in overpricing the assets. More specifically, investors are more active in the market when the market state is more optimistic, thereby disturbing prices away from fundamental values (Yu and

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[1] Kumar and Lee (2006) find that individual investors prefer to invest on small-cap, value, lower institutional ownership, and lower-priced stocks.

https://doi.org/10.1016/j.frl.2019.03.022
Received 6 June 2018; Received in revised form 3 March 2019; Accepted 11 March 2019
Available online 12 March 2019
1544-6123/

Yuan, 2011). Following this notion, Antoniou et al. (2013) evidence that profitability of momentum strategies follows an increase in market return. Moreover, Kumar et al. (2016) use the idea of style comovement to show that style comovement is stronger when local economic conditions are relatively good.[2] Therefore, style comovement may be higher following an increase in market return and thus generate stronger momentum profits.

The primary purpose of this study is to investigate the momentum effect across comovement portfolios in different market states. Prior literature finds that high comovement between stocks within style categories has stronger momentum effect due to style chasing (e.g., Barberis et al., 2005; Wahal and Yavuz, 2013). Extending that argument, this style chasing behavior may be stronger when market return is high, triggering style chasing investors to purchase more style stocks, and thus influencing stock prices. Consequently, momentum strategies are more profitable following an increase in market return. To examine the relation between momentum profits and style stocks, we measure the style comovement. Each month, we measure the comovement of stock with respect to its style by estimating its beta with respect to style returns over the prior six months (Barberis et al., 2005; Wahal and Yavuz, 2013). Then we independently sort all stocks into comovement terciles (C1 to C3). We show that the momentum on high style comovement portfolios are more profitable than low style comovement portfolios across evaluation horizons. The momentum return pattern of high style comovement portfolio increases monotonically during evaluation horizons of under six months (3-and 6-month holding periods), and it weakens over a longer evaluation horizon (12-month holding period). Our results are shown to be robust by the CAPM and three-factor model (Fama and French, 1993) risk-adjusted momentum profits and using 36-month market return.

We further investigate whether momentum returns of style comovement depend on market states. By using 12-month market return, our findings show that momentum returns on the high style comovement portfolios in UP market states are higher than in DOWN market states. The magnitudes of momentum effect on high style comovement portfolio are stronger than on low style comovement portfolios during UP markets. Extended to a 12-month holding period, the magnitude of momentum returns on high style comovement stocks following UP market states are weak. Our findings evidence that the momentum strategies on high style comovement portfolios are more profitable under UP market states. Collectively, these results suggest that the investors' built-up optimism, as reflected by an increase in market return, will strengthen style chasing behavior and trigger them to invest more on style stocks, thereby increasing comovement within style stocks and generate asymmetrical momentum profits.

This study contributes to the existing literature on comovement under style investing, by demonstrating that comovement is positively related to momentum returns and has positive predictability for stock returns. However, the influence of style comovement on momentum profits can be more significant when the market state is optimistic. This study helps to better understand the influence of market states on the relation between momentum return and style comovement. The rest of this paper is organized as follows. Section 2 defines the style stocks classification. Section 3 describes the main data, the portfolio construction, definition of market states and measurement for style comovement. In Section 4, we test the momentum profits of style comovement portfolios on different market states, and Section 5 concludes.

2. Style stocks classification

Prior literature suggests that most of investors categorize assets into many classes when allocating portfolios (Bernstein, 1995; Swensen, 2000). By using this classification, investors tend to allocate funds by styles rather than according to individual securities (Barberis and Shleifer, 2003). Accordingly, assets grouped into style categories share a common characteristic, which can be in markets (e.g., small-cap stocks). One simple and commonly used criteria for style classification is size and book-to-market ratio (Wahal and Yavuz, 2013), widely used by both individual investors and mutual funds. There is also growing evidence that retail and institutional investors allocate capital into style level using size and value-growth dimensions (Froot and Teo, 2008; Kumar, 2009). Specifically, the style classification should satisfy three conditions: (1) widely followed by investors, (2) spanning the asset class (domestic equity in our study), and (3) mutually exclusive (Wahal and Yavuz, 2013). Cooper et al. (2005) show that some mutual funds strategically change their name to reflect a "hot style" (in size or value-growth) to attract retail investors, thereby increasing comovement between style stocks (Boyer, 2011).

3. Style stocks and momentum

3.1. Data and methodology

Stock return data are from the Center for Research in Security Prices (CRSP), including all stocks traded on the NYSE, AMEX, and NASDAQ from January 1965 to September 2017. We also obtain the CRSP value-weighted stock index from CRSP and translate it into monthly returns as a proxy for market portfolio return. Compustat is used for the equity book values to calculate the book-to-market (BM) ratios of individual firms. The Kenneth French online data library is the source for monthly risk-free rates (on one-month Treasury bills) and returns on risk factors, including the market excess returns (MKT), the small-minus-big firm returns (SMB) and the high-minus-low book-to-market returns (HML).[3] Following Fama and French (1992), we multiply shares outstanding by the end of

[2] Kumar et al. (2016) categorize lottery-type stocks as a style investing to measure the style comovements. Their findings show that investors with a greater propensity to gamble will trade lottery-like stocks more actively and that those trades are more strongly correlated.

[3] We thank Kenneth French for providing the time-series of three risk factors. These risk factors are from: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

month prices for size and divide book values at fiscal year-end $t-1$ with a market value of equity for BM ratios in December of year $t-1$.

To measure the comovement of style investing, we use the interaction of size and BM ratio quintiles from all stocks at the end of June each year, and stocks are then assigned to style portfolios. Based on this style portfolio assignment, we estimate the style beta from the following univariate regression of daily stock returns on the daily style returns (Vijh, 1994; Barberis et al., 2005; Wahal and Yavuz, 2013). The style returns are the value-weighted returns of all stocks in the style, using the beginning of month market capitalization, and the regression is as follows.

$$R_{ic,d} = \alpha_i + \beta_{ic} R_{c,d} + \varepsilon_{i,d}, \tag{1}$$

where $R_{ic,d}$ is the return of stock i belonging to style c on day d, and $R_{c,d}$ is the value-weighted return of style portfolio on day d. We exclude stock i in calculating the return of the style portfolio (R_c) when running the regression on that stock, to avoid any misleading correlation between stock i and the style portfolio. We select the past six months of daily returns as the estimation window and require each stock to have at least 60 return observations. The regression is estimated rolling forward one month at a time to generate time series estimates of β_{ic}. Accordingly, stock comovement is calculated with respect to the past returns of its style. Additions or deletions of stocks to a style affect only future (not past) style returns (Wahal and Yavuz, 2013). Following these procedures, we use β_{ic} as the base for sorting all stocks into three style comovement portfolios (C1, C2, and C3), where C3 (C1) is the tercile with the highest (lowest) style comovement.

To investigate the relation between style comovement and momentum, we rank stocks into deciles based on the prior six-month cumulative returns at the end of each month, the top decile being the "winners" portfolio, and the bottom decile the "losers" portfolio, and then take a long position on the winner portfolio and a short position in the loser portfolio to form the momentum strategy, held for K (K = 3, 6, and 12) months. Accordingly, portfolios are formed overlapping in each holding-period month to increase the power of tests. To calculate the multi-month holding period returns, if a stock delists at any time during the holding months, we assume its future monthly returns over that holding period are zeros, except for a stock whose missing returns are higher than one-third during the holding period.[4] To avoid microstructure biases (such as bid-ask spread and price pressure), we skip a month between the portfolio formation period and the holding period. The returns for stocks contained in each decile are calculated using equal- and value-weighted strategies. Following Jegadeesh and Titman (1993), in portfolio formation we exclude stocks with a negative BM ratio and those under $5. The monthly value-weighted style returns use the beginning of month market capitalization of each stock in the month.

We calculate the average monthly momentum returns and adjusted momentum returns by estimating the CAPM and Fama and French (1993) risk factors (hereafter, FF-(1993)) across style portfolios. In accordance with Cooper et al. (2004), we perform risk adjustment using the time series of raw momentum returns corresponding to each month of the holding period. To form the CAPM- and FF-(1993) risk-adjusted profits, for each holding period month, portfolio returns are regressed on the risk factors and a constant. This procedure yields estimated factor loadings for each portfolio and holding-period month, which we use to derive risk-adjusted profits as follows:

$$r_{kt}^{adj} = r_{kt} - \sum_i \beta_{ik} f_{it}, \tag{2}$$

where r_{kt} is the raw returns of momentum portfolio in the holding-period month K in calendar month t; f_{it} is the realization of factor i in calendar month t; and β_{ik} is the estimated factor loading in month K on f_{it} for the momentum portfolio. For CAPM-adjusted momentum returns, we use the excess return of the value-weighted market index (MKT), which is the market return (R_m) over the 1-month T-bill return (R_f) as a proxy for market portfolio. FF-(1993) risk adjustment uses the excess returns of market index, the small-minus-big firm returns (SMB) and the high-book-to-market-minus-low-book-to-market returns (HML). These risk-adjustment methods can capture the covariance portion of the risk premiums in each holding-period strategy,[5] and thus improve the accuracy of results.

3.2. Style comovement and momentum

Barberis and Shleifer (2003) argue that stocks belonging to a style experience the same level of investor flows, so this style chasing behavior makes stock returns more predictable. Specifically, an increase in style chasing investment is associated with higher comovement within style stocks, thereby influencing the variation on momentum profits (Wahal and Yavuz 2013). To demonstrate this, we use the interaction of the loser (bottom decile) and winner (top decile) portfolios with style comovement terciles (C1, C2 and C3, respectively) to investigate the pattern of the momentum effect in style terciles, particularly for C1 and C3 terciles, with the empirical results reported in Table 1.

The equal-weighted average momentum returns (Panel A) with the high style comovement tercile (High Cov) are positive and statistically significant over all holding-period months (K = 3, 6 and 12). With the high style comovement terciles, the momentum

[4] For instance, with the 6-month holding period, if a stock delists in month 5, we assume its month 6 return is zero and retain the six-month holding period return; however, with the 12-month holding period, we exclude this stock from the calculation.

[5] Existing literature indicates that an asset will behave differently during different economic states (Bollerslev et al., 1988; Ferson and Harvey, 1999; Adrian and Franzoni, 2009). For example, Jagannathan and Wang (1996) suggest that the financial leverage of firms in relatively poor shape may increase sharply relative to other firms, causing their stock betas to rise during a recession. This behavior creates scenarios that invalidate financial theories.

Table 1
Momentum returns for style comovement based portfolios.

	Low Cov (C1)	C2	High Cov (C3)	C3-C1	Low Cov (C1)	C2	High Cov (C3)	C3-C1
		Equal-weighted				Value-weighted		
Panel A Average return								
$K = 3$	0.545**	0.952***	1.332***	0.786***	0.525**	0.884***	1.298***	0.773***
	(2.834)	(3.729)	(4.595)	(3.514)	(2.784)	(3.641)	(4.266)	(3.376)
$K = 6$	0.707***	1.084***	1.380***	0.673***	0.654**	0.926***	1.313***	0.659***
	(3.261)	(3.941)	(4.743)	(3.332)	(2.971)	(3.566)	(4.689)	(3.292)
$K = 12$	0.456**	0.597**	0.993***	0.694***	0.428**	0.560**	0.884***	0.626**
	(2.633)	(2.852)	(4.184)	(3.174)	(2.596)	(2.895)	(3.585)	(2.954)
Panel B CAPM								
$K = 3$	0.832***	1.118***	1.393***	0.461**	0.851***	1.045***	1.304***	0.404**
	(3.540)	(4.123)	(4.748)	(2.325)	(3.592)	(4.027)	(4.592)	(2.165)
$K = 6$	0.906***	1.190***	1.517***	0.611**	0.833***	1.105***	1.420***	0.587**
	(3.695)	(4.247)	(5.156)	(2.983)	(3.551)	(4.184)	(4.751)	(2.914)
$K = 12$	0.582**	0.829***	1.055***	0.473**	0.506**	0.779***	1.006***	0.500**
	(2.908)	(3.492)	(3.893)	(2.296)	(2.683)	(3.433)	(3.893)	(2.311)
Panel C FF-(1993)								
$K = 3$	0.939***	1.138***	1.396***	0.447**	0.874***	1.058***	1.329***	0.454**
	(3.760)	(4.354)	(4.804)	(2.276)	(3.619)	(4.165)	(4.773)	(2.299)
$K = 6$	0.930***	1.221***	1.540***	0.610**	0.876***	1.151***	1.483***	0.607**
	(3.743)	(4.390)	(5.395)	(2.972)	(3.623)	(4.173)	(4.987)	(2.925)
$K = 12$	0.621**	0.859***	1.121***	0.500**	0.535**	0.792***	1.058***	0.522**
	(2.987)	(3.521)	(4.261)	(2.762)	(2.861)	(3.459)	(3.918)	(2.819)

This table presents average and risk-adjusted momentum profits for style comovement portfolios. Each month, the β_{ic} for each stock is estimated with respect to its style portfolio (determined by the interaction of size and book-to-market quintiles) according to the regression equation $R_{ic,d} = \alpha_i + \beta_{ic}R_{c,d} + \varepsilon_{i,d}$ where $R_{ic,d}$ is the return of stock i belonging to style c on day d, and $R_{c,d}$ is the value-weighted return of style portfolio on day d. R_{ic} consists of style stocks after removing stock return i from the matching style portfolio. The regression is estimated using six months of daily returns and rolling forward a month, thus producing a time series of comovement coefficients (β_{ic}). All stocks are sorted into terciles (C1, C2 and C3) based on their β_{ic}. Then we independently rank stocks into deciles based on their prior six-month cumulative returns and calculate portfolio returns across style comovement terciles. We skip a month between the portfolio formation period and the subsequent holding period. The risk-adjusted momentum profits are calculated from Fama and French (1993) risk-factor (FF-(1993)) equation $r_{kt}^{adj} = r_{kt} - \sum_i \beta_{ik} f_{it}$, where r_{kt} is the raw returns of momentum portfolio in the holding-period month K, in calendar month t, f_{it} is the realization of factor i in calendar month t, and β_{ik} is the estimated factor loading in month K on f_{it}. We use the excess returns of the value-weighted market index (MKT), which is the market return (R_m) over the 1-month T-bill return (R_f) as the proxy for market portfolio, the small-minus-big firm returns (SMB) and the high-book-to-market-minus-low-book-to-market returns (HML) for the FF-(1993) risk adjustment. For the CAPM, we regress on excess market returns (MKT) according to equation $r_{kt} = r_{kt} - \beta_k(R_m - R_f)$, where β_k is the estimated factor loading in holding-period month K on the excess market returns. Using these loadings and the factor realizations in each month, we estimate the monthly excess return for each portfolio. The sample consists of all involving all NYSE, Amex and Nasdaq stocks from January 1965 to September 2017. Newey-West (1987) adjusted t-statistics are reported in parentheses. In addition, *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively

strategies produce monthly averages of 1.380% (t-statistic = 4.743) for equal-weighted and 1.313% (t-statistic = 4.689) for value-weighted portfolios in the 6-month holding period. The magnitudes of momentum returns on C3 are higher under the 6-month holding period, and weaken over longer a holding period ($K = 12$). These results show that the momentum profits on high style comovement portfolios are greater than on low style comovement portfolios. With the 6-month holding period, the average return differences (C3-C1) are 0.673% (t-statistic = 3.332) for equal-weighted and 0.659% (t-statistic = 3.292) for value-weighted portfolios. Extended to the 12-month holding period ($K = 12$), the return spreads between C3 and C1 decrease due to the larger decrease in momentum profits on C3.

Given risk adjustments, for both equal- and value-weighted portfolios, momentum returns by adjusted CAPM (Panel B) and FF-(1993) (Panel C) on high style comovement portfolios (High Cov) remain more profitable than on low comovement portfolios across all holding periods. Momentum profits are highly significant in the 6-month holding period, with monthly averages returns of 1.517% (CAPM) and 1.540% (FF-(1993)) on high style comovement portfolios when using the equal-weighted strategy. Over longer holding periods, the momentum profits decrease. There are similar patterns for value-weighted portfolios, showing that momentum returns are higher in the short-run (the 6-month holding periods) and weaken in longer horizons (12-month holding periods). Our findings are consistent with Wahal and Yavuz (2013), demonstrating that style stocks are likely to attract inflows when they perform well in the most recent period and thus increase comovement within style stocks. Consequently, the higher comovement within style stocks generated by style chasing leads to higher momentum profits.

Table 2
Average momentum returns for style comovement portfolios in different market states.

	$K = 3$			$K = 6$			$K = 12$		
	UP ($N = 509$)	DOWN ($N = 118$)	UP-DOWN	UP ($N = 509$)	DOWN ($N = 118$)	UP-DOWN	UP ($N = 509$)	DOWN ($N = 118$)	UP-DOWN
Panel A: 12-month market return									
Panel A1 Equal-weighted									
Low Cov (C1)	0.838***	0.249	0.589**	0.988***	0.415**	0.574**	0.692***	0.217	0.475**
	(3.506)	(1.599)	(2.708)	(3.841)	(2.118)	(2.592)	(3.147)	(1.511)	(2.265)
C2	1.520***	0.382*	1.139***	1.666***	0.491**	1.176***	0.936***	0.260	0.676***
	(4.891)	(1.869)	(4.267)	(4.940)	(2.381)	(4.432)	(3.791)	(1.466)	(3.133)
High Cov (C3)	1.893***	0.766***	1.127***	1.973***	0.770***	1.203***	1.539***	0.437**	1.102***
	(5.463)	(3.280)	(4.375)	(5.700)	(3.480)	(4.299)	(4.935)	(2.287)	(4.264)
C3-C1	1.022***	0.313*	0.506**	0.979***	0.455**	0.523**	0.847***	0.219	0.627**
	(3.932)	(1.719)	(2.706)	(3.752)	(2.361)	(2.753)	(3.551)	(1.567)	(2.933)
Panel A2 Value-weighted									
Low Cov (C1)	0.796***	0.230	0.565***	0.926***	0.387**	0.539**	0.648**	0.172	0.476**
	(3.448)	(1.544)	(2.936)	(3.756)	(2.087)	(2.513)	(3.089)	(1.134)	(2.284)
C2	1.360***	0.349*	1.010***	1.495***	0.392**	1.103***	0.890***	0.235	0.655**
	(4.481)	(1.764)	(3.876)	(4.608)	(2.186)	(4.318)	(3.867)	(1.326)	(3.067)
High Cov (C3)	1.822***	0.732***	1.090***	1.913***	0.723***	1.190***	1.438***	0.332*	1.106***
	(5.460)	(3.422)	(4.014)	(5.540)	(3.374)	(4.390)	(4.532)	(1.861)	(4.287)
C3-C1	1.014***	0.502**	0.511**	0.988***	0.436**	0.552**	0.790***	0.163	0.630**
	(3.911)	(2.697)	(2.747)	(3.829)	(2.314)	(2.783)	(3.312)	(1.091)	(3.054)
Panel B: 36-month market return									
Panel B1 Equal-weighted									
Low Cov (C1)	0.758***	0.281	0.477**	0.885***	0.463**	0.423**	0.650***	0.261	0.389**
	(3.346)	(1.632)	(2.269)	(3.680)	(2.397)	(2.297)	(3.094)	(1.534)	(2.124)
C2	1.467***	0.417**	1.049***	1.614***	0.537**	1.076***	0.956***	0.245	0.711**
	(4.736)	(2.197)	(4.344)	(4.962)	(2.581)	(4.294)	(3.798)	(1.451)	(3.090)
High Cov (C3)	1.731***	0.686**	1.046***	1.883***	0.939***	0.944***	1.481***	0.493**	0.988***
	(5.329)	(3.062)	(3.967)	(5.487)	(3.786)	(3.795)	(4.790)	(2.384)	(3.832)
C3-C1	0.973***	0.404**	0.569	0.997***	0.476**	0.521**	0.832***	0.232	0.599**
	(3.806)	(2.180)	(2.813)	(3.812)	(2.379)	(2.770)	(3.514)	(1.475)	(2.871)
Panel B2 Value-weighted									
Low Cov (C1)	0.738***	0.269	0.469**	0.855***	0.449**	0.406**	0.611**	0.233	0.377**
	(3.293)	(1.587)	(2.218)	(3.508)	(2.329)	(2.200)	(2.792)	(1.498)	(2.106)
C2	1.367***	0.387**	0.980***	1.439***	0.421**	1.018**	0.900***	0.177	0.723***
	(4.489)	(2.103)	(3.786)	(4.583)	(2.464)	(4.176)	(3.693)	(1.195)	(3.113)
High Cov (C3)	1.646***	0.659**	0.987***	1.856***	0.904***	0.952***	1.372***	0.394**	0.977***
	(5.285)	(2.927)	(3.802)	(5.318)	(3.635)	(3.686)	(4.528)	(2.167)	(3.760)
C3-C1	0.908***	0.391**	0.517**	1.001***	0.455**	0.546**	0.761***	0.161	0.600**
	(3.684)	(2.117)	(2.756)	(3.890)	(2.314)	(2.799)	(3.213)	(1.061)	(2.875)

This table presents average monthly momentum returns for style comovement portfolios in different market states. Each month, the β_{ic} for each stock is estimated with respect to its style portfolio (determined by the interaction of size and book-to-market quintiles) according to the regression equation $R_{ic,d} = \alpha_i + \beta_{ic}R_{c,d} + \varepsilon_{i,d}$ where $R_{ic,d}$ is the return of stock i belonging to style c on day d, and $R_{c,d}$ is the value-weighted return of style portfolio on day d. R_{ic} consists of style stocks after removing stock return i from the matching style portfolio. The regression is estimated using six months of daily returns and rolling forward a month, thus producing a time series of comovement coefficients (β_{ic}). We sort all stocks into terciles (C1, C2 and C3) based on their β_{ic}. We independently rank stocks into deciles based on their prior six-month cumulative returns and calculate portfolio returns across style comovement terciles. We skip a month between the portfolio formation period and the subsequent holding period. Panel A reports the market states classified on the return of the lagged value-weighted market index, where non-negative (negative) returns of the value-weighted CRSP index over months $t-12$ to $t-1$ define UP (DOWN) markets. Panel B reports the market states classified on the return of the lagged value-weighted market index, where non-negative (negative) returns of the value-weighted CRSP index over months $t-36$ to $t-1$ define UP (DOWN) markets. The sample consists of all involving all NYSE, Amex and Nasdaq stocks from January 1965 to September 2017. Newey-West (1987) adjusted t-statistics are reported in parentheses. In addition, *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

4. Style momentum returns and market states

Previous empirical results show that momentum strategies are more profitable on high style comovement stocks. For our final objective, in this section we examine style momentum profits in different market states. The results are reported in Table 2 for average momentum profits and Table 3 for risk-adjusted momentum profits, respectively.

Table 3
Risk-adjusted momentum profits for style comovement portfolios in different market states.

	$K = 3$			$K = 6$			$K = 12$		
	UP ($N = 509$)	DOWN ($N = 100$)	UP-DOWN	UP ($N = 509$)	DOWN ($N = 100$)	UP-DOWN	UP ($N = 509$)	DOWN ($N = 100$)	UP-DOWN
Panel A: 12-month market return									
Panel A1 CAPM: Equal-weighted									
Low Cov (C1)	1.052***	0.674***	0.378*	1.126***	0.686***	0.439**	0.756***	0.296	0.461**
	(4.043)	(3.097)	(1.906)	(4.216)	(3.179)	(2.282)	(3.370)	(1.583)	(2.349)
	$K = 3$			$K = 6$			$K = 12$		
	UP ($N = 509$)	DOWN ($N = 100$)	UP-DOWN	UP ($N = 509$)	DOWN ($N = 100$)	UP-DOWN	UP ($N = 509$)	DOWN ($N = 100$)	UP-DOWN
C2	1.355***	0.881***	0.474**	1.496***	0.883***	0.614**	1.183***	0.458**	0.725***
	(4.577)	(3.719)	(2.398)	(4.829)	(3.766)	(2.854)	(4.281)	(2.363)	(3.246)
High Cov (C3)	1.778***	1.009***	0.769***	1.930***	1.100***	0.830***	1.590***	0.522**	1.068***
	(5.397)	(4.017)	(3.442)	(5.547)	(4.186)	(3.745)	(4.961)	(2.759)	(4.157)
C3-C1	0.726***	0.335*	0.391**	0.804***	0.414**	0.390**	0.833***	0.226	0.607**
	(3.258)	(1.754)	(2.083)	(3.455)	(2.239)	(2.062)	(3.507)	(1.482)	(2.912)
Panel A2 CAPM: Value-weighted									
Low Cov (C1)	1.041***	0.626**	0.415**	1.053***	0.614**	0.439**	0.738***	0.266	0.472**
	(4.113)	(2.971)	(2.264)	(4.135)	(2.983)	(2.359)	(3.244)	(1.544)	(2.324)
C2	1.279***	0.803***	0.476**	1.367***	0.738***	0.629**	1.075***	0.421**	0.655**
	(4.473)	(3.480)	(2.396)	(4.596)	(3.267)	(2.845)	(4.066)	(2.288)	(3.038)
High Cov (C3)	1.714***	0.885***	0.829***	1.735***	0.889***	0.846***	1.502***	0.497**	1.005***
	(5.235)	(3.819)	(3.579)	(5.288)	(3.835)	(3.778)	(4.815)	(2.456)	(4.015)
C3-C1	0.674**	0.260	0.414**	0.693**	0.262	0.407**	0.764***	0.231	0.532**
	(3.006)	(1.572)	(2.242)	(3.087)	(1.597)	(2.251)	(3.292)	(1.519)	(2.798)
Panel A3 FF-(1993): Equal-weighted									
Low Cov (C1)	1.141***	0.731***	0.410**	1.176***	0.694**	0.482**	0.857***	0.382*	0.476**
	(4.422)	(3.267)	(2.215)	(4.487)	(3.009)	(2.381)	(3.762)	(1.760)	(2.378)
C2	1.375***	0.865***	0.510**	1.513***	0.921***	0.593**	1.195***	0.517**	0.678***
	(4.773)	(3.786)	(2.661)	(5.069)	(3.844)	(2.669)	(4.383)	(2.493)	(3.137)
High Cov (C3)	1.793***	0.959***	0.834***	1.965***	1.112***	0.852***	1.646***	0.590**	1.056***
	(5.397)	(3.958)	(3.788)	(5.554)	(4.370)	(3.824)	(5.188)	(2.608)	(4.246)
C3-C1	0.652**	0.228***	0.424**	0.789***	0.419**	0.370**	0.788***	0.208	0.580**
	(2.875)	(1.382)	(2.254)	(3.720)	(2.178)	(2.193)	(3.686)	(1.333)	(2.856)
Panel A4 FF-(1993): Value-weighted									
Low Cov (C1)	1.075***	0.673**	0.402**	1.095***	0.646**	0.449**	0.793***	0.311*	0.482**
	(4.274)	(2.913)	(2.193)	(4.343)	(2.864)	(2.258)	(3.669)	(1.657)	(2.396)
C2	1.285***	0.826***	0.459**	1.377***	0.881***	0.496**	1.106***	0.481**	0.625**
	(4.462)	(3.750)	(2.317)	(4.696)	(3.814)	(2.324)	(4.388)	(2.372)	(3.080)
High Cov (C3)	1.755***	0.892***	0.863***	1.835***	1.099***	0.736***	1.550***	0.552**	0.998***
	(5.350)	(3.912)	(3.825)	(5.439)	(4.317)	(3.574)	(5.020)	(2.512)	(3.975)
C3-C1	0.681**	0.219	0.461**	0.740***	0.453**	0.287	0.757***	0.241	0.516**
	(2.974)	(1.367)	(2.346)	(3.583)	(2.279)	(1.576)	(3.684)	(1.487)	(2.768)
Panel B: 36-month market return									
Panel B1 CAPM: Equal-weighted									
Low Cov (C1)	0.993***	0.696**	0.297	1.068***	0.750***	0.318*	0.745***	0.367*	0.379*
	(4.195)	(3.180)	(1.610)	(4.147)	(3.613)	(1.671)	(3.581)	(1.783)	(1.780)
C2	1.204***	0.835***	0.369**	1.393***	0.815***	0.577**	1.126***	0.513**	0.613**
	(4.424)	(3.784)	(2.171)	(4.725)	(3.792)	(2.562)	(4.324)	(2.445)	(2.902)
High Cov (C3)	1.679***	0.912***	0.767***	1.812**	1.209***	0.603**	1.527***	0.568**	0.959***
	(5.199)	(3.984)	(3.638)	(5.377)	(4.489)	(2.784)	(5.098)	(2.574)	(3.908)
C3-C1	0.686***	0.216	0.470**	0.745***	0.459**	0.285	0.782***	0.201	0.581**
	(3.139)	(1.379)	(2.418)	(3.676)	(2.383)	(1.537)	(3.782)	(1.387)	(2.839)
Panel B2 CAPM: Value-weighted									
Low Cov (C1)	0.950***	0.681***	0.269	0.960***	0.703***	0.257	0.718***	0.294	0.423**
	(3.960)	(3.118)	(1.488)	(4.029)	(3.450)	(1.467)	(3.483)	(1.572)	(2.313)
C2	1.184***	0.794***	0.390**	1.349***	0.788***	0.561**	1.077***	0.481**	0.596**
	(4.384)	(3.658)	(2.247)	(4.613)	(3.678)	(2.512)	(4.274)	(2.407)	(2.775)

(*continued on next page*)

Table 3 (*continued*)

	$K = 3$			$K = 6$			$K = 12$		
	UP ($N = 509$)	DOWN ($N = 100$)	UP-DOWN	UP ($N = 509$)	DOWN ($N = 100$)	UP-DOWN	UP ($N = 509$)	DOWN ($N = 100$)	UP-DOWN
High Cov (C3)	1.614***	0.881***	0.733***	1.722***	1.117***	0.605**	1.473***	0.528**	0.945***
	(5.138)	(3.867)	(3.559)	(5.271)	(4.392)	(2.807)	(4.763)	(2.496)	(3.884)
C3-C1	0.664**	0.200	0.464**	0.761***	0.413**	0.348*	0.755***	0.234	0.522**
	(3.080)	(1.357)	(2.381)	(3.738)	(2.279)	(1.983)	(3.658)	(1.443)	(2.802)
Panel B3 FF-(1993): Equal-weighted									
Low Cov (C1)	1.072***	0.811***	0.261	1.109***	0.751***	0.357**	0.818***	0.417**	0.401**
	(4.163)	(3.738)	(1.445)	(4.333)	(3.673)	(2.191)	(3.794)	(2.238)	(2.282)
C2	1.294***	0.958***	0.335**	1.447***	0.971***	0.476**	1.133***	0.577**	0.556**
	(4.472)	(4.061)	(2.192)	(4.789)	(4.014)	(2.382)	(4.370)	(2.683)	(2.683)
High Cov (C3)	1.741***	0.989***	0.753***	1.852***	1.180***	0.672***	1.585***	0.648**	0.937***
	(5.343)	(4.165)	(3.648)	(5.461)	(4.432)	(3.198)	(5.101)	(2.888)	(3.836)
C3-C1	0.669***	0.178	0.492**	0.743***	0.429**	0.314*	0.767***	0.231	0.536**
	(3.148)	(1.174)	(2.511)	(3.611)	(2.358)	(1.834)	(3.739)	(1.420)	(2.853)
Panel B4 FF-(1993): Value-weighted									
Low Cov (C1)	1.030***	0.718***	0.312*	1.035***	0.712***	0.323**	0.740***	0.329**	0.411**
	(4.095)	(3.547)	(1.673)	(4.031)	(3.485)	(2.139)	(3.577)	(2.088)	(2.325)
C2	1.217***	0.897***	0.320*	1.322***	0.950***	0.372**	1.074***	0.506**	0.568**
	(4.329)	(3.875)	(1.702)	(4.576)	(3.966)	(2.217)	(4.146)	(2.562)	(2.707)
High Cov (C3)	1.688***	0.942***	0.746***	1.761***	1.093***	0.668***	1.494***	0.608**	0.886***
	(5.246)	(3.967)	(3.614)	(5.376)	(4.182)	(3.167)	(4.963)	(2.785)	(3.782)
C3-C1	0.658**	0.224	0.434**	0.726***	0.381**	0.344**	0.754***	0.279	0.475**
	(2.910)	(1.438)	(2.377)	(3.589)	(2.236)	(2.217)	(3.638)	(1.583)	(2.423)

This table presents risk-adjusted momentum profits calculated from CAPM and FF-(1993) models for style comovement portfolios in different market states. For each momentum portfolio and holding-period month we form a time series of returns, which we regress on excess market return (MKT), as well as the SMB and HML factors when we risk adjust according to the FF-(1993) three-factor model. The risk-adjusted momentum profits are calculated from Fama and French (1993) risk-factor (FF-(1993)) equation $r_{kt}^{adj} = r_{kt} - \sum_i \beta_{ik} f_{it}$, where r_{kt} is the raw returns of momentum portfolio in the holding-period month K, in calendar month t, f_{it} is the realization of factor i in calendar month t, and β_{ik} is the estimated factor loading in month K on f_{it}. We use the excess returns of the value-weighted market index (MKT), which is the market return (R_m) over the 1-month T-bill return (R_f) as the proxy for market portfolio, the small-minus-big firm returns (SMB) and the high-book-to-market-minus-low-book-to-market returns (HML) for the FF-(1993) risk adjustment. For the CAPM, we regress on excess market returns (MKT) according to equation $r_{kt} = r_{kt} - \beta_k(R_m - R_f)$, where β_k is the estimated factor loading in month K on the excess market returns. Using these loadings and the factor realizations in each month, we estimate the monthly excess return for each portfolio. We independently sort stocks based on their style comovement and prior six-month cumulative returns and then calculate portfolio returns. For momentum strategy, we skip a month between the portfolio formation period and the subsequent holding period. Panel A presents the market states classified by the returns for the lagged value-weighted market index, where non-negative (negative) returns of the value-weighted CRSP index over months $t-12$ to $t-1$ define UP (DOWN) markets. Panel B reports the market states classified on the return of the lagged value-weighted market index, where non-negative (negative) returns of the value-weighted CRSP index over months $t-36$ to $t-1$ define UP (DOWN) markets. The sample consists of all involving all NYSE, Amex and Nasdaq stocks from January 1965 to September 2017. Newey-West (1987) adjusted t-statistics are reported in parentheses. In addition, *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Using 12-month market returns (Panel A), the results show that momentum profits on the high style comovement tercile (High Cov) following UP market states are higher than following DOWN market states. The average momentum profits on the high style comovement tercile (High Cov) following UP market states are 1.973% (t-statistic = 5.700) for equal-weighted (Panel A1) and 1.913% (t-statistic = 5.540) for value-weighted portfolios (Panel A2) in the 6-month holding period. The momentum profits on high style comovement following UP market state terciles decrease in the 12-month holding-period but remain profitable. However, in a DOWN market, using momentum strategies with high style comovement earns negative profits. The return differences (UP-DOWN) on high style comovement terciles, for both equal-weighted and value-weighted strategies, are statistically and significantly positive over all evaluation horizons. These findings indicate that momentum strategies on high style comovement portfolios following UP market states are more profitable than following DOWN market states. By comparison, the spreads for momentum profits between high and low style comovement terciles (C3-C1) are higher with the UP market. For equal-weighted and value-weighted strategies, the return differences (C3-C1) are positive across evaluation horizons and all are significant at a 1% significance level.

There are similar results when using the lagged three-year market return as an alternative measurement for market states (Panel B). Momentum strategies on high style comovement terciles (High Cov) yield higher momentum profits following UP market states than following DOWN. In the 6-month holding period, momentum strategies with the high style comovement tercile earn average returns of 1.731% (t-statistic = 5.329) for equal-weighted and 1.646% (t-statistic = 5.285) for value-weighted portfolios following UP market states. By comparison, momentum profits on high style comovement terciles (High Cov) are lower when the market is

DOWN. The momentum profits on high style comovement terciles are 0.686% (t-statistic = 3.062) for equal-weighted and 0.659% (t-statistic = 2.927) when holding period is 6 months. The return differences on the high style comovement tercile between UP and DOWN market states are significantly positive over the evaluation horizons by using 36-month market returns, similar to the results of 12-month market return.

We resolve this issue by estimating FF-(1993) and CAPM-adjusted momentum returns across different market states, as reported in Table 3. Our findings are robust to these risk adjustments, showing the positive momentum returns on high style comovement portfolios following UP market states. For example, when using 12-month market returns (Panel A) for measurement, the momentum strategies on C3 produce an average of 1.746% for CAPM-adjustment (Panels A1 and A2) and 1.774% for FF-(1993)-adjustment (Panels A3 and A4) in the 6-month holding period when a momentum strategy is implemented in UP market states. These risk-adjusted momentum profits on high style comovement terciles are significant at a 1% significance level. In the 12-month holding period, the momentum strategies on high style comovement portfolios (C3) remain profitable in UP market states. Momentum profits on C3 are stronger than on C1 following UP market states, and the return differences between C3 and C1 are significantly positive over evaluation horizons. There are similar results using 36-month market returns (Panel B), demonstrating that the momentum strategies on high style comovement terciles produce higher profits than on low style comovement terciles when the market state is UP. Collectively, these findings imply that investor style chasing behavior is stronger with increased market optimism. Stronger style chasing behavior leads investors to invest more in style stocks, so these stocks are more strongly correlated, and this generates asymmetrical momentum profits across both UP and DOWN market states.

5. Conclusion

Recently, Wahal and Yavuz (2013) evidence that the comovement of style investing has positively predictability for momentum return due to investors' style chasing. However, style chasing behavior may depend on market states and thus generate asymmetrical momentum profits. Specifically, when market optimism grows, increased investor optimism will strengthen style chasing behavior. As a result, higher style comovement resulting from stronger style chasing behavior is associated with greater momentum profits following market gains.

To evaluate this notion, we estimate the style beta for each stock by using univariate regression of daily stock returns on the daily style returns and rank stocks into terciles based on their style betas to form momentum strategy. To investigate the influence of market states on the relation between style comovement and momentum profits, we follow Cooper et al. (2004) in using market return to define the market states as UP (DOWN) if the one-year lagged market return is non-negative (negative). Findings show that the momentum returns on style comovement portfolio are stronger following UP market states than following DOWN market states. In UP market states, the momentum profits on high style comovement portfolios are more profitable than on low style comovement portfolios. Our findings evidence that market states clearly influence the relation between style comovement and momentum profits. Overall, these findings suggest that increased investor optimism will strengthen style chasing behavior and thus style stocks are more strongly correlated by actively trading, leading to higher momentum effect. Hence, style investing has an asymmetrical influence on momentum profits.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.frl.2019.03.022.

References

Adrian, T., Franzoni, F., 2009. Learning about beta: time-varying factor loadings, expected returns, and the conditional CAPM. *J. Empir. Finance* 16, 537–556.
Antoniou, C., Doukas, J.A., Subrahmanyam, A., 2013. Cognitive dissonance, sentiment, and momentum. *J. Financ. Quant. Anal.* 48, 245–275.
Barberis, N., Shleifer, A., 2003. Style investing. *J. Financ. Econ.* 68, 161–199.
Barberis, N., Shleifer, A., Wurgler, J., 2005. Comovement. *J. Financ. Econ.* 75, 283–317.
Bernstein, R., 1995. Style Investing. Wiley, New York.
Brown, G.W., Cliff, M.T., 2005. Investor sentiment and asset valuation. *J. Bus.* 78, 405–440.
Boyer, B.H., 2011. Style-related comovement: fundamentals or labels? *J. Finance* 66, 307–332.
Cooper, M.J., Gulen, H., Rau, P.R., 2005. Changing names with style: mutual fund name changes and their effects on fund flows. *J. Finance* 60, 2825–2858.
Cooper, M.J., Gutierrez, R.C., Hameed, A., 2004. Market states and momentum. *J. Finance* 59, 1345–1365.
Bollerslev, T., Engle, R.F., Wooldridge, J.M., 1988. A capital asset pricing model with time-varying covariances. *J. Polit. Economy* 96, 116–131.
Fama, E.F., French, K.R., 1992. The cross-section of expected stock returns. *J. Finance* 47, 427–465.
Fama, E.F., French, K.R., 1993. Common risk factors in the returns on stocks and bonds. *J. Financ. Econ.* 33, 3–56.
Ferson, W.E., Harvey, C.R., 1999. Conditioning variables and the cross section of stock returns. *J. Finance* 54, 1325–1360.
Froot, K., Teo, M., 2008. Style investing and institutional investors. *J. Financ. Quant. Anal.* 43, 883–906.
Hong, H., Stein, J., 1999. A unified theory of underreaction, momentum trading, and overreaction in asset markets. *J. Finance* 54, 2143–2184.
Jagannathan, R., Wang, Z., 1996. The conditional CAPM and the cross-section of expected returns. J. Finance 51, 3–53.
Jegadeesh, N., Titman, S., 1993. Returns to buying winners and selling losers: implications for stock market efficiency. *J. Finance* 48, 65–91.
Kumar, A., 2009. Dynamic style preferences of individual investors and stock returns. *J. Financ. Quant. Anal.* 44, 607–640.
Kumar, A., Lee, C., 2006. Retail investor sentiment and return comovements. *J. Finance* 61, 2451–2486.
Kumar, A., Page, J.K., Spalt, O.G., 2016. Gambling and comovement. *J. Financ. Quant. Anal.* 51, 85–111.
Stambaugh, R.F., Yu, J., Yuan, Y., 2012. The short of it: investor sentiment and anomalies. *J. Financ. Econ.* 104, 288–302.
Swensen, D., 2000. Pioneering Portfolio Management. The Free Press, New York.
Vijh, A.M., 1994. S&P 500 trading strategies and stock betas. *Rev. Financ. Stud.* 7, 215–251.
Wahal, S., Yavuz, M.D., 2013. Style investing, comovement and return predictability. *J. Financ. Econ.* 107, 136–154.

Yu, J., Yuan, Y., 2011. Investor sentiment and the mean–variance relation. J. *Financ. Econ.* 100, 367–381.

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