

Investor Sentiment and Price Momentum

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Introduction

Does investor sentiment affect financial asset prices? This issue is enduring and has taken on renewed significance in the context of dramatic rises and falls in the stock market during this decade. In this paper, we address this question by examining whether variations in profitability from a key pattern in stock prices, namely stock price momentum, can be explained by variations in investor sentiment. Importantly, our measure of sentiment is exogenous to the financial markets, as it is measured by the Consumer Confidence Index® published by the Conference Board (CB), orthogonalized with respect to macroeconomic variables. We find that momentum profits are strongly related to sentiment, in that they accrue almost exclusively after periods of positive sentiment.

The phenomenon of price momentum has been documented in several studies [e.g., Jegadeesh and Titman (1993, 2001); Chan, Jegadeesh, and Lakonishok (1996)]. This return pattern is found to be robust in different markets [Rouwenhorst (1999); Doukas and McKnight (2002)] and different asset classes [Asness, Moskowitz, and Pedersen (2008)]. The highly debated¹ explanations for price momentum fall into three general categories: theories of market frictions [Hong and Stein (1999)], theories of time-varying expected returns [Johnson (2002)], and behavioral theories of market inefficiency [Daniel, Hirshleifer, and Subrahmanyam (1998)]. We consider the extent that psychological theories provide an adequate explanation for price momentum by examining the relationship between momentum-induced profits and investor sentiment.

¹ For example, Hong, Lim, and Stein (2000) show that, controlling for firm size, momentum profits are decreasing in analyst coverage, thus supporting the notion that momentum is caused by slow information diffusion. Chordia and Shivakumar (2002) find that momentum profits are largely predictable from a set of macroeconomic variables, proposing a rational explanation for momentum. Cooper, Gutierrez, and Martin (2004) find that momentum returns are entirely captured by lagged market returns, and suggest a behavioral explanation of momentum. For further discussions on the origins of momentum, see Conrad and Kaul (1998), Moskowitz and Grinblatt (1999), Grundy and Martin (2001), and Grinblatt and Han (2005).

Sentiment, broadly defined, refers to whether an individual, for whatever *extraneous* reason, feels excessively optimistic or pessimistic about a situation. A large body of the psychology literature finds that peoples' *current* sentiment affects their judgment of future events. For example, Johnson and Tversky (1983) show that people that read sad newspaper articles subsequently view various causes of death, such as disease etc., as more likely than people who read pleasant newspaper articles. In general, the evidence from experimental psychology shows that people with positive sentiment make optimistic judgments and choices, whereas people with negative sentiment make pessimistic ones [Bower (1981, 1991); Arkes, Herren, and Isen (1988); Wright and Bower (1992); among others].

Investor sentiment underlies the behavioral theory of Daniel, Hirshleifer, and Subrahmanyam (1998), who show that the momentum effect is generated by investors' overconfidence and self-attribution bias. Essentially, overconfident agents miscalibrate (over-assess) the precision of their private information signals, which causes an initial overreaction. They then assess new public information in a self-serving way (discounting information that contradicts their signals) leading to continuing overreaction and a sluggish correction; the latter phenomenon implying reversals in the long run. We argue that optimism is associated with extremely miscalibrated positive signals, and short-selling constraints prevent arbitrage from correcting prices. Therefore, prices tend to be pushed well above fundamental values, amplifying the momentum effect, and ultimately lead to long run reversals. A symmetric effect need not obtain in the case where investors are pessimistic, because in this case, stocks are undervalued, and arbitrage, that requires the taking of long positions in this case, may be more effective.

In a related paper Cooper, Gutierrez, and Hameed (2004) suggest that investors' behavioral biases will be more accentuated after market gains, and show that momentum is profitable only after increases. They interpret this finding as supportive of behavioral explanations for momentum. Our study corroborates this evidence by partitioning momentum profits on investor sentiment, a potentially more direct proxy of investors' propensity to form erroneous beliefs. We show that sentiment has incremental power to explain momentum-induced profits even after accounting for market returns. Chordia and Shivakumar (2002) show that momentum profits are only significant in periods in which the economy is expanding, and put forward a rational explanation of momentum. However, these authors are careful to point out that their findings are entirely consistent with a behavioral story where investors generate momentum during market expansions because they are excessively optimistic.² This is precisely the avenue we pursue in our study. We condition momentum profits on investor sentiment, and predict that momentum profits will be higher when investors are optimistic, and will eventually lead to long-term reversals as this optimism proves to be unfounded.

To ensure that our CB Index is free of macroeconomic influences, we follow Baker and Wurgler (2006, 2007) and conduct our investigation using an orthogonal version of the index, which is obtained by regressing the CB Index on a set of macroeconomic variables.³ The variables include growth in industrial production, real growth in durable, non-durable, and services consumption, growth in employment, and a National Bureau of Economic Research (NBER) recession indicator. Furthermore, we examine the sensitivity of our results

² Chordia and Shivakumar (2002) suggest that the challenge to this rationale would be to provide an explanation of why investors misinterpret market-wide information and become overly optimistic, misreacting to company-specific information. Investor sentiment provides such an explanation, since the general finding is that optimism that is unrelated to the decision at hand, i.e., optimism related to the state of the economy and not the individual company, can alter the choice made.

³ These macroeconomic indicators have been used by Baker and Wurgler (2006, 2007) in order to extract "excessive" investor sentiment from the sentiment index developed in Baker and Wurgler (2006).

to an alternative index for investor sentiment constructed by Baker and Wurgler (2006, 2007).

Our study is related to the recent literature that has produced important evidence that suggests that sentiment is priced.⁴ This has led several authors to explore the relationship between investor sentiment and various stock market anomalies. Thus, investor sentiment has been linked to the post earnings announcement drift [Livnat and Petrovic (2008)], fund flows and the value effect [Frazzini and Lamont (2008)], corporate disclosure [Bergman and Roychowdhury (2008)], IPOs [Cornelli, Goldreich, and Ljungqvist (2006)], and the size effect [Baker and Wurgler (2006, 2007)]. Our study extends this literature by analyzing the relationship between investor sentiment and momentum, an important stock market anomaly.

We show that when investor sentiment is optimistic, the six-month momentum strategy yields significant profits, equal to an average monthly return of 1.64%. However, when investor sentiment is pessimistic, momentum profits decrease dramatically to an *insignificant* monthly average of 0.56%. We also find that investor sentiment provides an important link between short-run continuation and long-run stock price reversal. We examine the long-run behavior of optimistic and pessimistic momentum portfolios six years after portfolio formation, and find that momentum profits revert *only* after optimistic periods, with a substantial average monthly loss of -0.34%.

Our tests help disentangle rational from behavioral explanations of momentum. We

⁴ See, for example, Hirshleifer and Shumway (2003), who use sunshine to capture investors' mood, and confirm that returns are higher on sunnier days. Edmans, Garcia, and Norli (2007) capture mood using sporting events, and find that after losses in international competitions, stock markets of losing nations fall. Brown and Cliff (2005) and Lemmon and Portniaguina (2006) use consumer confidence indices constructed from household surveys to proxy investors' sentiment, and find that asset returns decline following periods of optimism. Baker and Wurgler (2006) create a sentiment index from market-based variables and arrive at similar conclusions.

note that rational theories do not allow a role for investor sentiment in causing momentum or reversals. Further, we show that our results are robust to different size- and volume-sorted portfolios, alternative proxies for investor sentiment, the CAPM with conditional and unconditional betas, Fama and French (1993) risk adjustments, and controls for microstructure biases. Since our findings do not have any obvious rational explanation based on frictions or risk, our study indicates that behavioral theories are a more appropriate fit for the data.

The remainder of this paper is organized as follows. Section 1 describes the data and the empirical methodology. Section 2 presents the results, along with a discussion of the sensitivity analysis and robustness checks. Section 3 concludes the paper.

1. Data and Methodology

We use all common stocks (share codes 10 and 11) listed in the New York and American Stock Exchanges (NYSE and AMEX respectively) from the Center for Research in Security Prices (CRSP) monthly file. The sample time period is from February 1967 to December 2008, for which the monthly CB Index is available.

We construct momentum portfolios using the methodology of Jegadeesh and Titman (1993). In each month t , we sort all stocks on their returns for the past J months. Based on these rankings, ten equally weighted portfolios are formed. The top decile is called the “losers” portfolio, and the bottom decile the “winners” portfolio. Every month, the strategy takes a long position in the winner portfolio and a short position in the loser portfolio, held for K months. We construct overlapping portfolios to increase the power of our tests.

Specifically, we close the position initiated in month $t-K$ in both the winner and loser portfolios, and take a new position using the winners and losers of month t . Therefore, in each month, we revise $1/K$ of the stocks in the winner and loser portfolios, and carry over the rest from the previous month.⁵ In order to avoid microstructure biases, we allow one month between the end of the formation period and the beginning of the holding period, and delete all stocks that are priced less than one dollar at the beginning of the holding period.

As mentioned earlier, for the main part of our analysis we measure investor sentiment using the monthly time series of consumer confidence sentiment constructed by the CB. This survey began on a bimonthly basis in 1967 and turned into a monthly series in 1977.⁶ The CB questionnaire is sent to 5,000 randomly selected households in the United States, and asks participants five questions about their outlook for the economy.⁷ The scores for each question are calculated as the number of favorable replies, divided by the sum of favorable and unfavorable replies. The scores on the five questions are amalgamated to form the overall Consumer Confidence Index. The Index is one of the ten leading economic indicators published by the CB, and has been used in studies to predict household spending activity [Acemoglu and Scott (1994); Ludvigson (2004)]. Further, such measures of consumer confidence are positively related to investor optimism [Fisher and Statman (2002)], and have been used as proxies for investor sentiment [e.g., Lemmon and Portniaguina (2006)].

In order to purge the effects of macroeconomic conditions from the CB Index, we

⁵ For example, for the six-month formation-holding period strategy ($J, K=6$), in each month $t+1$, the winner portfolio is comprised of $1/6$ (winners from $t-1$) + $1/6$ (winners from $t-2$) + ... + $1/6$ (winners from $t-6$), and correspondingly for the loser portfolio. Note that month t is skipped.

⁶ For the period that the index is available on a bimonthly basis, we follow Qiu and Welch (2006) in using linear interpolation to obtain monthly observations.

⁷ The questions are the following: 1) How would you rate present general business conditions in your area? 2) What would you say about available jobs in your area right now? 3) Six months from now, do you think that the business conditions in your area will be better, same or worse? 4) Six months from now, do you think there will be more, same, or fewer jobs available in your area? 5) Would you guess your total family income to be higher, same, or lower 6 months from now?

regress this monthly index on six macroeconomic indicators: growth in industrial production, real growth in durable consumption, non-durable consumption, services consumption, growth in employment, and an NBER recession indicator, and use the residuals from this regression as the sentiment proxy.⁸

To identify whether a particular formation period is optimistic or pessimistic, we calculate a rolling average of the sentiment level for the three months prior to the end of the formation period.⁹ In order to ensure that our analysis is not sensitive to the definition of sentiment states, we report results using two different classifications of optimistic and pessimistic investor sentiment states. In the first specification a formation period is classified as optimistic (pessimistic) if the three-month rolling average ending in month t belongs in the top (bottom) 30% of the three-month rolling average sentiment time series. For robustness, we also present results when the breakpoints are defined using a more extreme 20% cutoff to classify optimistic and pessimistic periods.

Because we form overlapping portfolios, in each holding period month we hold stocks from K different formation periods, across which sentiment can differ. In order to calculate the average sentiment in these K formation periods, we first calculate whether each of these K formation periods was optimistic or pessimistic as explained above, and then tally how many were optimistic or pessimistic.¹⁰ If, from those K formation periods, at least 66% are identified as high (low) sentiment with the remaining 33% being classified as mild sentiment,

⁸ This sentiment indicator is also used by McLean and Zhao (2009).

⁹ The CB Index for month $t-1$ is made publicly available from the beginning of month t . Thus, to make sure that all the information we use is available upon portfolio construction, we classify the momentum portfolio formed at the end of month t as optimistic or pessimistic using the average residual sentiment from month t , $t-1$, and $t-2$. However, since sentiment is announced with a one-month delay, this actually corresponds to sentiment during months $t-1$, $t-2$, and $t-3$. We also consider an alternative sentiment specification where we use two instead of three lags and find that our results continue to hold. These results are reported later in the paper.

¹⁰ For example, assuming $K=6$, in June 1980 we hold stocks selected from six ranking periods ending in May, April, March, February, and January. For each of the six ranking periods, we calculate the sentiment level in the previous three months, and classify each formation period as being high, medium, or low sentiment.

the particular holding period month is classified as optimistic (pessimistic).¹¹

To test whether momentum profits in each sentiment state are equal to zero, we regress the time series of average monthly momentum profits on an optimistic sentiment dummy variable and a pessimistic sentiment dummy variable, with no intercept. To test if mean profits in *OPTIMISTIC* sentiment periods are different from profits in *PESSIMISTIC* sentiment periods, we regress average monthly momentum profits on an *OPTIMISTIC* sentiment dummy variable with a constant.¹² This approach helps preserve the full-time series of returns, and allows us to estimate *t*-statistics that are robust to autocorrelation and heteroskedasticity using Newey and West (1987) standard errors.

We also calculate the long-run performance of the momentum portfolios, focusing on the six-month formation/holding period strategy. We follow the methodology employed by Jegadeesh and Titman (2001), whereby for each momentum portfolio constructed, we define an event time that is equal to 13 months following the initial formation date.¹³ After this event date, we hold the portfolio for six years, and test whether portfolios formed in optimistic formation periods behave differently from those formed after pessimistic formation periods.

¹¹ The choice of two-thirds is subjective. Because the sentiment index we use is a residual, it varies substantially from month to month. For this reason, classifying as optimistic (pessimistic) the months where all *K* formation periods were optimistic (pessimistic) results in a very few observations in each group, and substantial loss of information. For example, when *K*=6 and optimistic (pessimistic) sentiment is defined as the top (bottom) 30% of the rolling average sentiment time series only 35 (48) holding period months were all formation periods pessimistic (optimistic). Using two-thirds as a cut-off point for the *K* formation periods provides a lower bound for each sentiment category that involves a substantial amount of the *K* formation periods falling into a particular sentiment category.

¹² In our analysis, we find that momentum profits after mild sentiment formation periods behave in a very similar way to momentum profits after high sentiment formation periods. Thus, we combine the high and mild sentiment categories into one group, and compare this group to the low sentiment category. However, our results hold when we split the sample into three sentiment categories. These results are presented in sections 2.2.6. and 2.3.

¹³ For example, the portfolio held in June 1980 was initiated in November 1979 (skipping December). This portfolio is based on overlapping returns, thus it is an equally-weighted portfolio of the positions initiated in January, February, March, April, and June. For this portfolio, the post-holding period starts in January 1981, after which we continue to hold the same portfolio using the equally-weighted structure for a period of six years.

Table 1 presents descriptive statistics for our sentiment index. Panel A is based on the raw data of consumer confidence provided by the CB. Panel B reports the three-month rolling average using the residuals from regressing the raw CB data on a set of macroeconomic variables. The raw CB Index, as shown in Figure 1, rises during the late 1960s, mid 1980s, and late 1990s, and falls during the 1970s and early 1990s. These patterns are in line with the evidence for investor sentiment discussed by Baker and Wurgler (2006). The fall in sentiment for the period 2006-2008 seems to be a reflection of the early signs of the current recession. As shown in Figure 1, the orthogonal version of our sentiment index to macroeconomic conditions is considerably more volatile than the raw CB index, which is to be expected since it reflects a regression residual. However, we can also observe from figure 1 that the 3-month rolling average of this residual, which is the sentiment measure used in our main analysis, considerably reduces this variation and tracks the raw CB index fairly closely (i.e., shows an upward trend when the index is rising and vice versa).

A robust finding in the literature is that investor sentiment is reflected in the size premium [Lee, Shleifer, and Thaler (1991); Baker and Wurgler (2006, 2007); Lemmon and Portniaguina (2006)]. The interpretation given to this finding is that optimistic investors are drawn to small stocks, thereby reducing the size premium in the following period. In order to validate our sentiment proxy, we test whether it captures this negative relationship with the size premium. Specifically, we regress the three-month average of residual sentiment ending in month t on the return of the Small minus Big portfolio (SMB)¹⁴ in month $t+1$ and a constant. Indeed, as expected, we obtain a coefficient of -0.01 (t -value = -2.22), which corroborates our proxy as a sentiment index.

¹⁴ We thank Kenneth French for making the SMB data available on his website (<http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/>).

2. The Empirical Evidence on Momentum Profits across Sentiment States

2.1 Investor Sentiment and Short-Run Momentum Profits

Our first empirical test examines the profitability of the momentum strategy conditioning on pessimistic and optimistic investor sentiment states. Table 2 presents the results for strategies that are based on a six-month ranking period (J) and holding periods (K) of three, six, and twelve months sorted by investor sentiment. In Panel A (B) pessimistic sentiment is defined as the bottom 30% (20%) of the rolling average sentiment time series.

The unconditional momentum strategy for the period 1966-2008, based on $J, K=6$, yields an average monthly profit of 1.38% (unreported result). This figure is comparable with studies of momentum for analogous time periods [Lee and Swaminathan (2000); Jegadeesh and Titman (2001)].

Momentum profits, however, are extremely sensitive to investor sentiment. In Panel A of Table 2, the six-month strategy ($J=6, K=6$) shows that the average monthly profits in optimistic periods are highly significant, at an average of 1.64% per month. However, in pessimistic periods the momentum profits shrink to a statistically insignificant monthly average of 0.56%. When the holding period is extended to twelve months ($J=6, K=12$), average monthly profits in optimistic periods are 1.03%, while they decline to 0.07% after pessimistic periods. Panel B, which relies on more extreme sentiment states, provides additional evidence in support of significant momentum profits only in optimistic states. These results show that momentum between optimistic and pessimistic sentiment states is

even more dramatic, with the 6-month (12-month) strategy yielding an insignificant monthly profit during pessimistic states of -0.10% (-0.90%). These results suggest that the unconditional momentum profits frequently documented in the literature arise mostly from optimistic states.

As stated earlier, these results corroborate the analysis of Chordia and Shivakumar (2002) and Cooper, Gutierrez, and Hameed (2004), who respectively find that momentum profits vary significantly according to whether the market has been rising or falling or whether the economy has been expanding or contracting. Going further, however, our analysis explicitly links the time series of momentum profits to investor sentiment.

Another interesting result that emerges from Table 2 is that returns of all momentum portfolios after pessimistic periods are *higher* than those following optimistic periods across all holding period horizons, and this pattern is stronger when pessimistic sentiment is defined as the bottom 20% of the rolling average time series (Panel B). This result is consistent with previous findings [Baker and Wurgler (2006, 2007)], suggesting that investors tend to overestimate the likelihood of *negative* events when they are pessimistic, setting prices lower. Furthermore, Table 2 demonstrates that higher profits due to momentum strategies in optimistic periods arise primarily because loser stocks exhibit higher momentum than winner stocks during pessimistic periods. This is consistent with the notion that investors disregard negative information about loser stocks during optimistic periods and arbitrage forces do not act on this phenomenon due to short-selling constraints. A symmetric effect does not obtain during pessimistic periods because investors who ignore positive information during pessimistic periods have their bias countervailed by arbitrage buyers.

Our results suggest that the momentum trading style is *not* a risk-free arbitrage opportunity, as the returns of the winner and the loser portfolios do not preserve their spread across both optimistic and pessimistic sentiment states. Significant profits obtain, however, when the momentum strategy is implemented only after optimistic periods.

2.2 Is the Effect of Investor Sentiment on Momentum Profits Robust?

This section examines the robustness of the evidence that momentum profits are only significant during optimistic investor sentiment periods. Throughout this section we continue to analyze the six-month formation and holding period strategy ($J=6$, $K=6$), and define sentiment as in Table 2.

2.2.1 Investor Sentiment, Momentum, and Market States

Cooper, Gutierrez, and Hameed (2004) propose that investors' behavioral biases will be accentuated after market gains and test whether the momentum profits are related to past market returns. They identify UP and DOWN market states using the returns of the market for a 36-month period prior to the beginning of the strategy's holding period. If this return is positive (negative), they classify the market state as UP (DOWN). Then, they compute momentum profits after UP and DOWN markets. Their results indicate that momentum profits are significant only after UP markets. This leads the authors to conclude that positive market returns amplify behavioral biases, which ultimately lead to momentum.

Market returns can, of course, be related to investor sentiment [Otoo (1999)], because, for example, as market returns increase, investors may potentially become more optimistic.

However, the relationship may not be exact for two reasons. First, some investors may hold contrarian expectations.¹⁵ These investors may become pessimistic when they perceive that the market has climbed too high. Second, our measure of sentiment is a broad survey on aspects other than financial markets, and is likely to be affected by factors over and beyond market returns. Indeed, for our entire sample period, we find that the correlation of the time series of lagged 36-month market returns and the average residual sentiment for the past three months is 0.21. This confirms that the relationship between market returns and investor sentiment is less than perfect.

Nevertheless, a correlation of 0.21 is significant and merits investigation. Therefore, we also classify each formation period as belonging to an UP or DOWN market independently of investor sentiment as in Cooper, Gutierrez, and Hameed (2004). We calculate the return of the value-weighted index including dividends for the 36-month period prior to the beginning of the strategy's holding period. If this return is positive (negative), we classify the market state as UP (DOWN). We then derive momentum profits for optimistic and pessimistic periods during UP and DOWN markets.

These results are reported in Table 3. In Panel A (B) we define pessimistic periods as the bottom 30% (20%) of the rolling average sentiment series. It can be seen that of the 500 holding period months in the sample, 436 (87.2%) occur after UP markets and only 64 (12.8%) in DOWN markets. Interestingly, in UP market states, we find considerable variation in investor sentiment, as 91 periods (or 21%) are classified as pessimistic in Panel A and 51 periods (or 12%) in Panel B. This provides support to the notion that market run-ups do not completely overlap with investor optimism.

¹⁵ See Grinblatt and Keloharju (2000), Chordia, Roll, and Subrahmanyam (2002), and Goetzmann and Massa (2002) for evidence on contrarian investors.

Momentum strategies in DOWN markets, as shown in Panels A1 and B1 of Table 3, produce insignificant momentum profits, regardless of investor sentiment. However, the number of observations is very small and, therefore, these results do not allow meaningful interpretation. In Panels A2 and B2 we observe that momentum profits in UP markets and optimistic investor sentiment produce significant average monthly momentum profits equal to 1.80%. However, in Panel A2, when investor sentiment is pessimistic in UP markets, momentum profits decline remarkably to an average of 0.80% per month, a number which is statistically significant (t -value = 1.61). Panel B2 captures a more dramatic effect of investor sentiment, as momentum profits in UP markets, in the presence of pessimistic investor sentiment, yield an average monthly profit of 0.07% (t -value=0.11). These results are consistent with our previous findings, which show that momentum profits are significantly larger when investor sentiment is optimistic.

In Table 4 we report regression results. In Panel A (B) we define pessimistic periods as the bottom 30% (20%) of the rolling average sentiment series. Panel A1 (B1), presents estimates based on the regression model of Cooper, Gutierrez, and Hameed (2004) (Table V, p. 1361), augmented with the investor sentiment. Specifically, we estimate the following model (omitting time subscripts):

$$Profits = b_0 + b_1 \text{Optimistic Sentiment} + b_2 \text{Pesimistic Sentiment} + b_3 \text{Market} + b_3 \text{Market}^2 + u \quad (1)$$

The variable *Profits* is the time series of average monthly momentum profits. Because we are conducting overlapping strategies, each observation of momentum profits corresponds to K formation periods, and thus K observations for investor sentiment. We first

classify each of these K sentiment observations as optimistic or pessimistic (top/bottom 30% in Panel A and top/bottom 20% in Panel B) as in Table 2 and then define *Optimistic (Pessimistic) Sentiment* as the average sentiment of the optimistic (pessimistic) formation periods. *Market* is the lagged market return of the value weighted index including dividends during the 36, 24 and 12- month periods prior to the beginning of the strategy's holding period. $Market^2$ is the square of the market return.

The regression results in Panels A1 and B1 of Table 4 show that momentum profits increase with the market return, but decrease with the squared market term, indicating a nonlinear relationship, and confirming the results of Cooper, Gutierrez, and Hameed (2004).¹⁶ Our results also show that the coefficient of *Optimistic Sentiment* is positive and significant across all market return specifications (36, 24 and 12-months). Specifically, in Panel A1 (B1), when we use a 36-month lagged market return, the coefficient on *Optimistic Sentiment* is equal to 0.0002 (0.0003) with a t -value of 1.85 (2.30). Whereas the magnitude of the coefficient is similar, its t -value increases to 1.89 (2.49) when the 24-month lagged market return is used and to 1.93 (2.52) when the 12-month lagged market return is used in the regressions. Similarly, the coefficient and t -value of the *Market* return decreases from 0.1166 (0.1158) with t -value 3.61 (3.58) for the 36-month return, to 0.0504 (0.0508) with t -value 1.31 for the 12-month return. Interestingly, while the results in Panel A display that *Optimistic Sentiment* predicts momentum profits independently of market returns they also show that it is a stronger predictor when the market return is calculated over shorter periods.

In Panels A2 and B2 of Table 4 we report results that exclude momentum profits after DOWN markets. We choose to exclude these observations because they are associated with

¹⁶ In unreported analysis (available on request) we run a regression identical to that of Cooper, Gutierrez, and Hameed (2004) (without the sentiment variables) and find results similar to theirs.

extremely adverse market conditions, characterized by reductions in liquidity [Chordia, Roll and Subrahmanyam (2001)], and increases in volatility [Bekaert and Wu (2000)]. During such times an aggressive investment style such as momentum cannot be easily implemented. Thus, by directing our attention to UP market states, we examine the relationship between momentum profits, market returns and investor sentiment during “normal” market conditions when momentum investing can be implemented more easily.

The results in Panels A2 and B2 show that the *only* significant variable in all three regression specifications of *Market* return (36, 24 and 12-month return) is *Optimistic Sentiment*. This suggests that investor sentiment has a distinct and positive association with momentum profits during UP market states in that momentum profits in UP market conditions are related to *Optimistic Sentiment* much more strongly than to past market returns.

In Panels A3 and B3, we report the results of a horse race regression between optimistic sentiment, pessimistic sentiment and market returns. These results confirm those in Panels A1 and B1. As before, *Optimistic Sentiment* is positive and significant in all three specifications of the market return, whereas the coefficient on *Pessimistic Sentiment* is insignificant. In addition, the results show that the effect of *Market* return on momentum decreases when market returns are calculated over shorter time periods. For the 36-month period In Panel A3 (B3) the coefficient on *Market* return is 0.047 (0.046) with t-value 1.97 (1.92) and decreases to an insignificant 0.035 with t-value 1.02 (1.00) for the 12-month period.

Overall the results in Tables 3 and 4 show that the investor sentiment effect, reported

in Table 2, is not a manifestation of the UP market effect documented by Cooper, Gutierrez, and Hameed (2004). Our findings instead suggest that investor sentiment captures a significant variation in momentum profits even after controlling for the state of the capital market.

2.2.2 Investor Sentiment, Momentum, and Trading Volume

Lee and Swaminathan (2000), show that trading volume is related to momentum profits. Particularly, they find that high volume portfolios generate higher momentum returns. Trading volume has also been linked to investors' behavioral biases [Odean (1999); Statman, Thorley, and Vorkink (2006)]. In light of this evidence, we examine whether the sentiment effect reported earlier (Table 2) is confined mainly to high trading volume portfolios.

As before, we use the same methodology to construct momentum portfolios. However, during the formation period, in addition to sorting stocks on their past returns, we also rank them on their average monthly turnover (trading volume/shares outstanding). We form ten momentum groups and three trading volume groups—high (30% highest turnover), middle (40%), and low (30%)—and derive momentum returns for each combination, separately for optimistic and pessimistic formation periods.

Table 5 presents momentum profits for each trading volume portfolios. In Panel A (B) we define optimistic periods as the top 30% (20%) and pessimistic periods as the bottom 30% (20%) of the rolling average sentiment series, respectively. The sentiment effect is found in all the volume portfolios. Whereas in optimistic periods momentum profits are highly significant for all volume portfolios, they tend to become insignificant during

pessimistic periods. In Panel A1 (B1) for the high volume portfolio, the momentum profits decline from an average monthly return of 1.77% (1.73%) during optimistic periods to 0.75% (0.25%) in pessimistic periods. The corresponding figures for the middle volume portfolio are 1.74% (1.67%) and 0.84% (0.08%), and for the low volume portfolio, 1.43% (1.42%) and 0.45% (-0.18%).

The finding that momentum is stronger amongst high volume stocks confirms the results of Lee and Swaminathan (2000). However, our results also delineate a role for sentiment in that the momentum return of the high volume portfolio after pessimistic periods is generally statistically insignificant.

2.2.3 Is it a Size Effect?

A large literature suggests that return predictability is stronger for smaller companies, which are held mostly by individual investors [Nagel (2005)], and entail higher arbitrage costs [D'Avolio (2002), Jegadeesh and Titman (1993, 2001)], show that momentum strategies are more profitable amongst smaller companies. In this section, we explore whether our previous results, reported in Table 2, depend on the size of the company.

We rank stocks at the end of the formation period according to firm size, and apply our momentum strategy separately to the 50% smallest and 50% largest companies.¹⁷ These results are reported in Panels A and B of Table 6 and show that sentiment affects momentum for both small and large stocks. In Panel A (B) optimistic periods are the top 30% (20%) while pessimistic periods are the bottom 30% (20%) of the rolling average sentiment series,

¹⁷ The size breakpoints are from Ken French's data library (mba.tuck.dartmouth.edu/pages/faculty/ken.french/).

respectively. For small stocks (Panels A1 and B1), we observe that momentum profits in optimistic periods decline from a monthly average of 1.83% (1.82%) to 0.84% (0.18%) in pessimistic periods. The corresponding figures for large companies are 0.92% (0.91%) and 0.11% (-0.37%).

Our evidence that momentum is generally larger for smaller companies confirms the findings of Jegadeesh and Titman (1993, 2001). Further, the evidence that the effect of sentiment is much more dramatic in smaller companies (an average monthly return differential of 0.99% in panel A1 and 1.64% in Panel B1) supports the argument of Baker and Wurgler (2006) that the effects of investor sentiment will be more pronounced in the smaller companies that are harder to value and hence more prone to subjective evaluations.

Overall, the sentiment effect documented in Table 2 is robust to firm size. Both small and large companies exhibit stronger price momentum in periods of optimistic investor sentiment.

2.2.4 Is it Risk?

While the evidence so far suggests that conditioning on investor sentiment has a dramatic impact on the profits of momentum strategies, we cannot rule out the possibility that the higher (lower) returns of the winner (loser) portfolio during periods of optimism load more (less) strongly on economically meaningful risk factors. We address this issue by estimating CAPM, Fama and French (FF), and Conditional CAPM (CCAPM)-adjusted momentum returns across different investor sentiment states.

Following the method in Cooper, Gutierrez, and Hameed (2004), we perform the risk adjustment by forming a time series of raw momentum returns corresponding to each event month of the holding period. Specifically, to form CAPM- and FF-risk adjusted profits, for each holding period month, portfolio returns are regressed on the appropriate factors and a constant. In this manner, we obtain estimated factor loadings for each portfolio and holding period month, which we use to derive risk-adjusted profits as follows:

$$r_{kt} = \alpha_k + \beta_{ik} f_{it} + \epsilon_{ikt} \quad (2)$$

where r_{kt} represents the raw returns of each momentum portfolio for the strategy 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 return of the value-weighted market index, R_m , over the one-month Treasury-bill return, R_f as the market portfolio in the CAPM, and, additionally, the return differential between small and big companies (SMB), and high and low book-to-market companies (HML), for the FF risk adjustment.¹⁸

For the CCAPM we allow the covariance between the returns of momentum portfolios with the excess market return to vary with investor sentiment. Particularly we estimate risk adjusted returns using the following model:

$$r_{kt} = \alpha_k + \beta_{ik} R_{m,t} + \beta_{ik}^{sent} S_{t-1} + \epsilon_{ikt} \quad (3)$$

where r_{kt} represents the raw returns of each momentum portfolio for the strategy in the holding period month K , in calendar month t , β_{ik} is the estimated factor loading in month K on the excess market return and β_{ik}^{sent} is the factor loading in month K on the interaction between

¹⁸ We thank Eugene Fama and Kenneth French for providing the data on Fama and French (1993) factors on the WRDS website.

the excess market return and investor sentiment during the formation period.¹⁹ The time-varying betas argument predicts that the covariance between momentum profits and excess market returns increases when sentiment is optimistic; therefore returns increase accordingly to compensate for the increase in the co-variation between momentum portfolios and the excess market return.²⁰

Table 7 shows the CAPM, FF and CCAPM-adjusted momentum profits. As before, in Panel A (B) we define optimistic periods the top 30% (20%) and pessimistic periods the bottom 30% (20%) of the rolling average sentiment series, respectively. The pattern of momentum profits, reported in Table 2, remains robust to these risk adjustments. In Panel A, momentum profits are highly significant, at a monthly average of 1.67% (CAPM), 1.82% (FF) and 1.67% (CCAPM), respectively, when the strategy is implemented in optimistic investor sentiment periods. However, in pessimistic periods momentum profits drop to a monthly average return of 0.56% (CAPM), 0.95% (FF) and 0.56% (CCAPM), respectively. Qualitatively similar results are shown in Panel B. Note that the CAPM and the CCAPM-adjusted returns are virtually indistinguishable, suggesting that beta does not depend on investor sentiment. This result is in line with the findings of Baker and Wurgler (2006).

Overall, it is reasonable to conclude that rational risk premia, at least in the context of the CAPM and the Fama and French (1993) models, are not able to explain the superior performance of momentum strategy in periods of optimistic investor sentiment.

¹⁹ Because we perform overlapping strategies for each portfolio return observation we have CB residuals from K formation periods. In Equation (4), *Sentiment* is the average sentiment from these K formation periods. Allowing beta to vary according to optimistic and pessimistic sentiment (as in table 3b) does not change any of the results.

²⁰ We do not perform a conditional FF specification because the SMB and HML factors may be related to sentiment in a manner that is consistent with a behavioral story. Therefore, allowing factor loadings between momentum returns and the HML and SMB portfolios to vary according to investor sentiment will produce inconclusive results.

2.2.4 An Alternative Sentiment Index

In this section, we examine the sensitivity of our results to an alternative index for investor sentiment using the monthly measure constructed by Baker and Wurgler (2006, 2007).²¹ These authors suggest that investor sentiment can be captured from various market-based variables that relate to investors' propensity to purchase stocks. They construct a sentiment time series using six sentiment-revealing variables: trading volume (measured as total NYSE turnover),²² dividend premium, closed-end fund discount, number and first day returns in IPOs, and the equity share in new issues. Because these variables are partly related to economic fundamentals, they regress each of these sentiment proxies against growth in industrial production, real growth in durable consumption, non-durable consumption, services consumption, growth in employment, and an NBER recession indicator, and use the residuals from this regression as the sentiment proxies. The overall sentiment index is the first principal component of the six sentiment proxies. For more detail on the construction of the index, see Baker and Wurgler (2006, 2007). This time series is available on a monthly basis from 1966 to 2005.

Table 8 reports Table 2-equivalent momentum results for optimistic and pessimistic periods, using the Baker and Wurgler sentiment measure. Aside from the replacement of the CB index with the Baker and Wurgler measure, all calculations remain the same as those in Table 2. Consistent with our earlier baseline findings, the new evidence confirms the difference in momentum profits between optimistic and pessimistic investor states even when we use an alternative investor sentiment index. Specifically, in Panel A, these results show

²¹ This index is available from Jeffrey Wurgler's website (<http://pages.stern.nyu.edu/~jwurgler/>).

²² To remove the time trend from the turnover, Baker and Wurgler (2006, 2007) use log turnover minus a five year moving average.

that momentum profits in optimistic periods are equal to an average monthly return of 1.49%, whereas in pessimistic periods they drop to an insignificant 0.62%. Consistent with our previous evidence, this difference is more pronounced in Panel B where optimistic (pessimistic) periods are defined as those that fall into the top (bottom) 20% of the sentiment rolling average time series, with the optimistic sentiment periods generating an average monthly momentum return of 1.53%, which is reduced dramatically to -0.13% in pessimistic periods. These findings corroborate that our previous results and show that they are not driven by the choice of sentiment index.

2.2.5 Alternative Lags for Optimistic and Pessimistic Sentiment

In our analysis so far, we classify each formation period as pessimistic or optimistic using a rolling average of the residual sentiment level during a three-month window prior to the beginning of the holding period. In this section, we examine the sensitivity of our results to average sentiment calculated as the average of the two months prior to the end of the formation period. In Panel A (B) of Table 9 we define pessimistic periods as the bottom 30% (20%) of the rolling average sentiment series.

As shown in Panels A and B of Table 9, our main results hold for this alternative sentiment specification. Momentum strategies in optimistic periods consistently yield significant average monthly profits of 1.64% (Panel A) and 1.53% (Panel B). These profits, however, decline substantially in pessimistic periods, equaling 0.36% (Panel A), and 0.14% (Panel B). Overall, these results confirm that our baseline findings are robust to a different definition of investor sentiment.

2.2.6 Alternative Definitions for Optimistic and Pessimistic Sentiment

As stated earlier, we initially define a holding period month as optimistic or pessimistic if at least two-thirds of the K formation periods in that month are classified as optimistic or pessimistic using the rolling average of investor sentiment. This yields three sentiment categories, an optimistic, a pessimistic, and a “mild” sentiment category. In the analysis thus far, we have not explicitly considered the mild category. We find, however, that momentum profits after “mild” sentiment formation periods behave in a very similar way to momentum profits after optimistic sentiment periods. In Table 10, we present results whereby momentum profits are split into three categories to demonstrate this similarity. In Panel A (B) we define pessimistic periods as the bottom 30% (20%) of the rolling average sentiment series.

As seen from Panels A and B Table 10, momentum profits increase with investor sentiment. In Panel A for low sentiment periods, they are equal to a monthly average of 0.56%, as reported previously. For the “mild” sentiment category, monthly profits increase to 1.52%; for the high sentiment category, they increase to 1.94%. The corresponding figures in Panel B are -0.10%, 1.55% and 2.07%. These results demonstrate two things. First, there is a monotonic positive relationship between momentum profits and sentiment and second, this relationship is very strong as we move from pessimistic sentiment states into “mild” sentiment states, and flattens out as we move into optimistic sentiment states. Thus, pooling the “mild” and high optimistic sentiment categories allows us to gain statistical power, without losing significant information.

As a further exploration of the relationship between our work and that of Cooper,

Gutierrez, and Hameed (2004), Table 11 presents average monthly returns momentum strategies implemented after UP markets and conditioned on optimistic, pessimistic and mild investor sentiment. Panels A and B respectively present results for the 30% and 20% classifications of optimistic and pessimistic states. As can be seen, momentum profits increase monotonically across the three states (optimistic, mild and pessimistic). In addition, the difference between momentum profits across optimistic and pessimistic states is significant, and more strongly so in the case of the 20% classification of sentiment states. Overall this again confirms the notion that sentiment adds explanatory power to momentum profits beyond market returns.

2.3 Momentum Profits, Investor Sentiment and Long-Run Returns

A central prediction of behavioral theories such as Daniel, Hirshleifer, and Subrahmanyam (1998) is that momentum profits reflect unrealistic expectations, and thus revert in the long run. Since in the previous section we documented that momentum profits are *only* significant when investors are optimistic, we would expect these profits to reverse over longer horizons. In this section, we examine the pattern of momentum profits in event time, six years after portfolio formation.

Table 12 presents the results. In Panel A (B) we define pessimistic periods as the bottom 30% (20%) of the rolling average sentiment series. From the panels we see that momentum profits revert *only* after optimistic periods, regardless of whether returns are risk-adjusted. For portfolios constructed in optimistic formation periods using raw returns, this reversal in Panel A1 is equal to an average monthly return of -0.34%. The corresponding figure for CAPM (FF)-adjusted returns is -0.34% (-0.22). However, for portfolios

constructed in pessimistic periods, as expected, there is no reversal. The momentum returns are equal to -0.00 (raw and CAPM returns) and 0.20 (FF returns), respectively. Identical results are shown in Panel B.

In Table 13, we classify the momentum portfolios according to three categories of investor sentiment, as in Table 10. In Panel A (B) we define pessimistic periods as the bottom 30% (20%) of the rolling average sentiment series. These results exhibit the same monotonic relationship between long-run reversals and investor sentiment as documented in Table 10 between sentiment and short-run momentum profits. Specifically, in Panel A, raw reversals during the six-year post holding period (Panel A1) are equal to a monthly average of -0.47 for optimistic sentiment portfolios, -0.29% for mild sentiment portfolios, and -0.01 for pessimistic sentiment portfolios. Similar results are shown for CAPM (Panel A2) and FF (Panel A3)-adjusted returns, as well as in Panel B where optimistic and pessimistic sentiment is captured with a 20% breakpoint.

These results suggest that the trading actions of optimistic investors lead to short-run momentum by forcing stock prices above fundamental values. As these expectations fail to materialize, investor sentiment subsides with momentum profits fading away, and stock prices reverting to fundamental values in the long run. This finding provides support to the behavioral model of Daniel, Hirshleifer, and Subrahmanyam (1998), which predicts that short-run momentum and long-run stock price reversal commonly arise from investors' behavioral biases.

These results provide an important link between short-run price momentum and long-run reversal. Cooper, Gutierrez, and Hameed (2004) and Lee and Swaminathan (2000)

document such links. The former authors show that momentum profits revert after UP markets, where short-run momentum is significant. However, they also find that momentum profits revert after DOWN markets, and the difference in the reversals between UP and DOWN markets is not significant. Lee and Swaminathan (2000) find that trading volume also predicts reversals, albeit differently for winners and losers.²³ Our study corroborates this evidence by showing that investor sentiment predicts a significant difference in the long-run performance of momentum portfolios.

3. Concluding Remarks

Price momentum is an anomaly not captured by the Fama and French (1996) three-factor model. It has been linked to both rational and behavioral explanations. In this paper, we provide evidence on the validity of behavioral explanations by examining the relationship between price momentum and investor sentiment.

Our hypothesis is that that when investors are very optimistic, they are more miscalibrated, which leads to mispricing in equities. Further, arbitraging the resulting mispricing is difficult due to short-selling constraints. This leads to stronger short-run momentum and larger long-run price reversal during periods of optimism. Our results indicate that price momentum is significant *only* when investors are optimistic. This result is robust to firm size, trading volume, market states, risk adjustments, and alternative specifications for investor sentiment. In addition, we show that price reversals occur *only* after optimistic periods. Collectively, these results are supportive of the notion that short-run momentum and long-run price reversal jointly arise from investors' behavioral biases.

²³ They find that momentum portfolios comprised of high volume winners and low volume losers exhibit reversals, whereas the opposite classifications result to continuations.

The recent findings of Chul, Titman and Wei (2009), which show that momentum is more pronounced in individualistic cultures, raises the question of whether the asymmetric momentum pattern we have documented for the U.S., where individualistic attitudes are considered to be the higher than in the rest of the world, gains support in countries characterized by less individualism. Exploration of this issue would seem to be an interesting area for future research.

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Figure 1
Investor sentiment (CB) from 1966-2008

This figure plots three series. The first is the raw data of consumer confidence provided by the Conference Board. The second series is the residual from regressing the CB index series on the following set of macroeconomic variables: growth in industrial production, real growth in durable consumption, non-durable consumption, services consumption, growth in employment, and an NBER recession indicator. The third series is the 3-month rolling average of the residual.

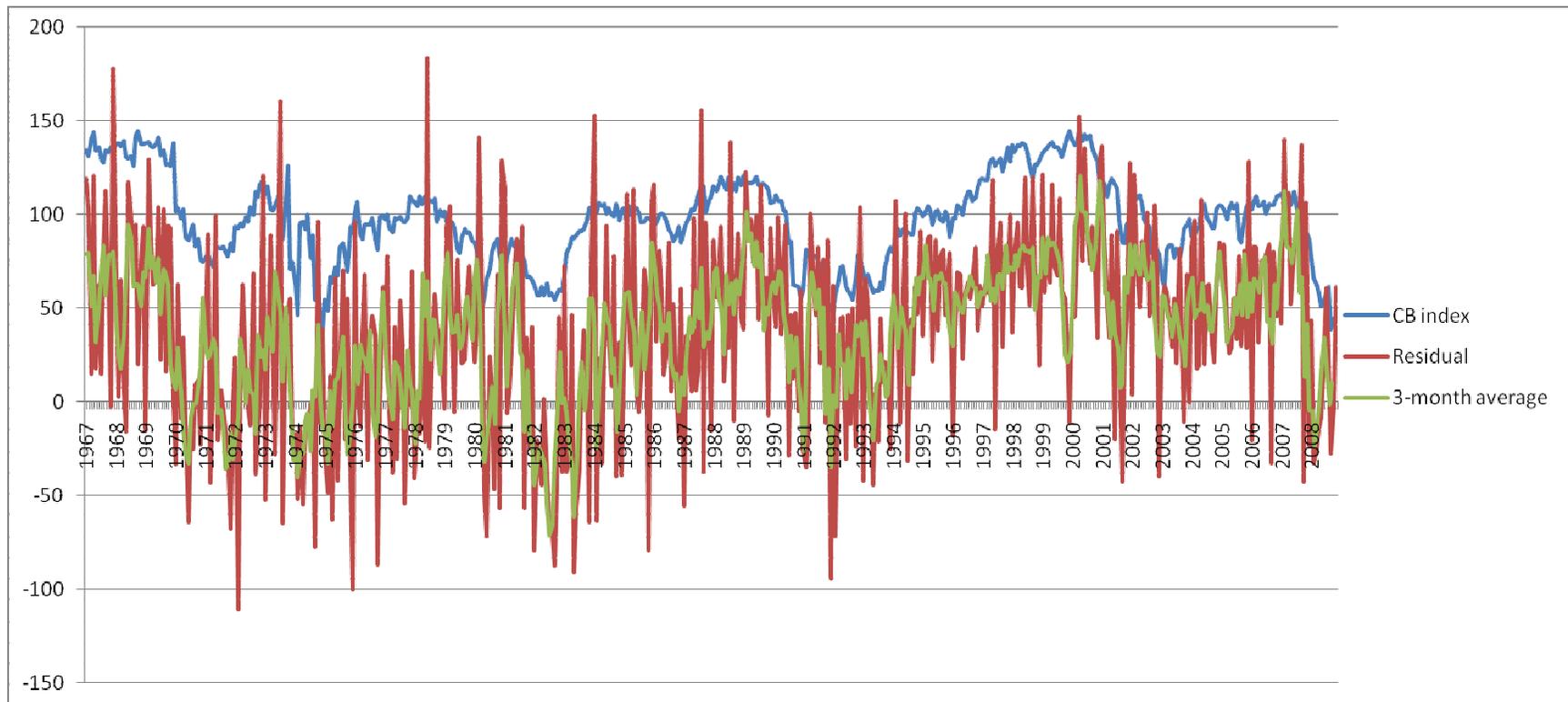


Table 1
Descriptive Statistics

Panel A presents descriptive statistics for the raw time series of consumer confidence, as compiled by Conference Board. Panel B presents the 3 month rolling average of the component of investor sentiment that is orthogonal to macroeconomic conditions. To derive this component we regress raw sentiment on growth in industrial production, real growth in durable, non-durable, and services consumption, growth in employment, and an NBER recession indicator, and then use the residuals from this regression to calculate the 3-month rolling average. The sample period is April 1967 to December 2008.

Panel A: CB consumer confidence

Mean	σ	Q1	Median	Q3	Minimum	Maximum	N
97.40	23.06	82.59	98.00	110.60	38.62	144.71	503

Panel B: CB consumer confidence orthogonal to macroeconomic variables

35.19	34.26	13.27	40.93	61.21	-74.99	116.94	501
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Table 2
Momentum Profits Conditional on Investor Sentiment

This table presents average monthly returns in percentages for price momentum strategies involving all NYSE/AMEX stocks for the time period April 1967 until December 2008. At the beginning of each month all stocks are ranked based on their cumulative returns over the previous J months. Portfolio 1 includes the loser stocks and portfolio 10 the winner stocks. The winner stocks are bought and the loser stocks sold, and this position is held for K months. Monthly holding period returns come from overlapping strategies and are computed as an equal-weighted average of returns from strategies initiated at the beginning of this month, and the previous $K-1$ months. We allow one month between the end of the formation period and the beginning of the holding period, and delete all stocks that are priced less than one \$1 at the beginning of the holding period. Sentiment is measured using the time series of consumer confidence sentiment index constructed by Conference Board. We regress this series on growth in industrial production, real growth in durable, non-durable, and services consumption, growth in employment, and an NBER recession indicator, and use the residuals from this regression as the sentiment proxy. In order to identify whether a particular formation period was optimistic or pessimistic, in each month t we calculate the average sentiment level for the previous 3 months. In Panel A (B) the top 30% (20%) observations of this rolling average time series are the high sentiment periods, and the bottom 30% (20%) the low sentiment periods. To identify each holding period month as optimistic and pessimistic, we calculate how many of the K formation periods that were used to select the stocks that are held that month were of high and low sentiment. If at least 2/3 of these periods are low sentiment periods while the remaining 1/3 are mild sentiment periods we classify the month as pessimistic. The rest are the optimistic months. To test whether momentum profits in each sentiment state respectively are equal to zero, we regress the time series of average monthly momentum profits on an Optimistic sentiment dummy variable and a Pessimistic sentiment dummy variable, with no intercept. To test if mean profits in Optimistic sentiment periods are different from profits in Pessimistic sentiment periods we regress average monthly momentum profits on an Optimistic sentiment dummy variable with a constant. The t -statistics of the significance of momentum profits and the difference between profits derived after optimistic and pessimistic periods are calculated using Newey-West standard errors, where the lag is set to $K-1$.

		Momentum Portfolio											
		1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	[t-stat.]
Panel A: 30%-30% Sentiment States													
<i>Panel A1: J=6, K=3</i>													
Optimistic	(n=357)	-0.24	0.44	0.78	0.89	0.97	1.00	1.08	1.06	1.20	1.41	1.65	[6.30]
Pessimistic	(n=143)	0.87	1.41	1.54	1.57	1.54	1.54	1.53	1.46	1.48	1.58	0.71	[1.51]
											Opt.-Pes	0.94	[1.76]
<i>Panel A2: J, K=6</i>													
Optimistic	(n=378)	-0.14	0.47	0.74	0.85	0.97	1.03	1.13	1.17	1.32	1.50	1.64	[7.36]
Pessimistic	(n=122)	0.92	1.33	1.54	1.59	1.56	1.56	1.51	1.52	1.47	1.48	0.56	[1.30]
											Opt.-Pes.	1.08	[2.11]
<i>Panel A3: J=6, K=12</i>													
Optimistic	(n=410)	0.18	0.56	0.79	0.87	0.99	1.04	1.12	1.17	1.22	1.22	1.03	[5.48]
Pessimistic	(n=90)	1.51	1.82	1.89	1.86	1.79	1.70	1.66	1.62	1.57	1.58	0.07	[0.18]
											Opt.-Pes.	0.96	[2.26]

Table 2, continued

		Panel B: 20%-20% Sentiment states											
		1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	[t-stat.]
<i>Panel B1: J=6, K=3</i>													
Optimistic	(n=403)	-0.27	0.44	0.76	0.85	0.93	0.96	1.03	1.00	1.13	1.29	1.57	[6.55]
Pessimistic	(n=97)	1.54	1.90	1.99	2.06	1.98	1.95	1.94	1.89	1.93	2.15	0.61	[0.96]
											Opt.-Pes	0.94	[1.42]
<i>Panel B2: J, K=6</i>													
Optimistic	(n=428)	-0.23	0.39	0.70	0.79	0.90	0.97	1.06	1.11	1.23	1.40	1.63	[8.03]
Pessimistic	(n=72)	2.14	2.41	2.55	2.47	2.42	2.33	2.20	2.17	2.10	2.04	-0.10	[-0.15]
											Opt.-Pes.	1.73	[2.51]
<i>Panel B3 : J=6, K=12</i>													
Optimistic	(n=454)	0.13	0.53	0.75	0.84	0.94	0.99	1.06	1.11	1.16	1.17	1.04	[5.92]
Pessimistic	(n=46)	3.30	3.35	3.34	3.18	3.02	2.85	2.73	2.63	2.47	2.40	-0.90	[-1.45]
											Opt.-Pes	1.94	[2.92]

Table 3

Momentum Profits Conditional on Market States and Investor Sentiment

This table presents average monthly returns in percentages for price momentum strategies involving all NYSE/AMEX stocks for the time period April 1967 until December 2008. Panel A shows momentum strategies implemented in DOWN markets, whereas Panel B momentum strategies implemented after UP markets. The state of the market is the return of the value weighted market index 36 month prior to beginning of the holding period, as measured by Cooper et al (2004). We allow one month between the end of the formation period and the holding period, and delete all stocks that are priced less than one \$1 at the beginning of the holding period. Sentiment is defined as in table 2. To test whether momentum profits in each sentiment state respectively are equal to zero, we regress the time series of average monthly momentum profits on an Optimistic sentiment dummy variable and a Pessimistic sentiment dummy variable, with no intercept. To test if mean profits in Optimistic sentiment periods are different from profits in Pessimistic sentiment periods we regress average monthly momentum profits on an Optimistic sentiment dummy variable with a constant. In this table $J, K=6$.

		Momentum Portfolio											
		Panel A: 30%-30% Sentiment states											
<i>Panel A1: DOWN market</i>		1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	[t-stat.]
Optimistic	(n=33)	1.18	0.76	0.71	0.88	0.78	0.83	0.98	1.00	1.15	1.24	0.06	[0.05]
Pessimistic	(n=31)	2.48	2.67	2.67	2.71	2.58	2.56	2.56	2.44	2.22	2.34	-0.13	[-0.10]
											Opt.-Pes.	0.19	[0.11]
<i>Panel A2: UP market</i>													
Optimistic	(n=345)	-0.27	0.44	0.75	0.85	0.99	1.05	1.14	1.19	1.33	1.52	1.80	[7.01]
Pessimistic	(n=91)	0.39	0.88	1.15	1.20	1.22	1.22	1.15	1.21	1.21	1.19	0.80	[1.61]
											Opt.-Pes.	1.00	[1.78]
		Panel B: 20%-20% Sentiment states											
<i>Panel B1: DOWN market</i>													
Optimistic	(n=43)	1.25	1.11	1.08	1.29	1.18	1.26	1.41	1.4	1.42	1.45	0.20	[0.18]
Pessimistic	(n=21)	2.95	2.86	2.85	2.73	2.62	2.48	2.42	2.3	2.17	2.44	-0.51	[-0.33]
											Opt.-Pes.	0.71	[0.38]
<i>Panel B2: UP market</i>													
Optimistic	(n=385)	-0.39	0.31	0.62	0.74	0.87	0.93	1.02	1.07	1.2	1.4	1.79	[7.40]
Pessimistic	(n=51)	1.81	2.23	2.42	2.37	2.33	2.26	2.1	2.11	2.07	1.88	0.07	[0.11]
											Opt.-Pes.	1.72	[2.43]

Table 4

Regressions of Momentum Profits on Market Returns and Investor Sentiment

Market is the return of the value weighted market index 36, 24 and 12 months prior to beginning of the holding period, and market return² is the square term of the market return. For each momentum profit observation (which corresponds to K formation periods due to overlapping strategies) we calculate average optimistic and pessimistic sentiment (defined as in Table 2) in the K formation periods. If all K formation periods correspond to optimistic (pessimistic) sentiment the value for pessimistic (optimistic) is set to 0. T- statistics are calculated using Newey-West standard errors, where the lag is set to $K-1$. In this table $J, K=6$.

Panel A: 30%-30% Sentiment states

	Parameter	36-month market return			24-month market return			12-month market return		
		Estimate	t- statistic	Adj.R ²	Estimate	t- statistic	Adj.R ²	Estimate	t- statistic	Adj.R ²
<i>Panel A1: Cooper et al regression with sentiment: Mom. profits = $b_0 + b_1 \cdot \text{Opt. sentiment} + b_2 \cdot \text{Pess. sentiment} + b_3 \cdot \text{Market} + b_4 \cdot \text{Market}^2 + u$</i>										
Constant	b_0	-0.0012	-0.19	0.0287	0.0027	0.44	0.022	0.003	0.52	0.008
Optimistic sentiment	b_1	0.0002	1.85		0.0002	1.89		0.0002	1.93	
Pessimistic Sentiment	b_2	-0.0002	-0.98		-0.0002	-1.00		-0.0001	-0.90	
Market return	b_3	0.1166	3.61		0.0847	2.19		0.0504	1.31	
Market return ²	b_4	-0.4009	-3.27		-0.4631	-2.33		-0.487	-1.64	
<i>Panel A2: Cooper et al regression with sentiment in UP markets: Mom. profits = $a_0 + b_1 \cdot \text{Opt. sentiment} + b_2 \cdot \text{Pess. sentiment} + b_3 \cdot \text{UPmarket ret.} + b_4 \cdot \text{UPmarket ret.}^2 + u$</i>										
Mom. profits = $b_0 + b_1 \cdot \text{Opt. sentiment} + b_2 \cdot \text{Pess. sentiment} + b_3 \cdot \text{UPmarket ret.} + b_4 \cdot \text{Upmarket ret.}^2 + u$										
Constant	b_0	-0.0056	-0.56	0.005	0.0024	0.25	0.003	-0.0037	-0.50	0.023
Optimistic sentiment	b_1	0.0002	2.00		0.0002	1.78		0.0003	2.91	
Pessimistic Sentiment	b_2	-0.0002	-0.94		-0.0001	-0.91		-0.0002	-1.30	
Market return	b_3	0.1425	1.29		0.1327	0.90		0.1731	1.08	
Market return ²	b_4	-0.4216	-1.34		0.6871	-1.17		-1.26	-1.41	
<i>Panel A3: Horse race between market returns, optimistic and pessimistic sentiment: Mom. profits = $b_0 + b_1 \cdot \text{Market} + b_2 \cdot \text{Opt. sentiment} + b_3 \cdot \text{Pess. sentiment} + u$</i>										
Constant	b_0	-0.002	-0.32	0.013	-0.0012	-0.18	0.011	0.0002	0.06	0.006
Market return	b_1	0.0470	1.97		0.0470	1.61		0.035	1.02	
Optimistic Sentiment	b_2	0.0002	1.60		0.0002	1.82		0.0002	1.97	
Pessimistic sentiment	b_3	-0.0001	-0.71		-0.0001	-0.75		-0.0001	-0.66	

Table 4, continued

Panel B: 20%-20% Sentiment states										
		36-month market return			24-month market return			12-month market return		
	Parameter	Estimate	t- statistic	Adj.R ²	Estimate	t- statistic	Adj.R ²	Estimate	t- statistic	Adj.R ²
<i>Panel B1: Cooper et al regression with sentiment: Mom. profits = b₀ + b₁*Opt. sentiment + b₂*Pess. sentiment + b₃*Market + b₄*Market² + u</i>										
Constant	b ₀	-0.005	-0.83	0.031	-0.002	-0.36	0.025	-0.001	-0.23	0.011
Optimistic sentiment	b ₁	0.0003	2.30		0.0003	2.49		0.0003	2.52	
Pessimistic Sentiment	b ₂	-0.0004	-1.68		-0.0004	-1.90		-0.0004	-1.91	
Market return	b ₃	0.1158	3.58		0.086	2.25		0.0508	1.31	
Market return ²	b ₄	-0.4039	-3.22		-0.4614	-2.33		-0.5125	-1.71	
<i>Panel B2: Cooper et al regression with sentiment in UP markets: Mom. profits = b₀ + b₁*Opt. sentiment + b₂*Pess. sentiment + b₃*UPmarket ret. + b₄*UPmarket ret.² + u</i>										
Constant	b ₀	-0.0078	-0.75	0.007	-0.001	-0.11	0.006	-0.005	-0.71	0.022
Optimistic sentiment	b ₁	0.0003	2.19		0.0003	2.10		0.0003	2.85	
Pessimistic Sentiment	b ₂	-0.0003	-1.10		-0.0003	-1.10		-0.0003	-1.37	
Market return	b ₃	0.1322	1.19		0.1303	0.88		0.175	1.09	
Market return ²	b ₄	-0.3984	-1.26		-0.671	-1.14		-1.286	-1.44	
<i>Panel B3: Horse race between market returns, optimistic and pessimistic sentiment: Mom. profits = b₀ + b₁*Market + b₂* Opt. sentiment + b₃* Pess. sentiment + u</i>										
Constant	b ₀	-0.006	-0.91	0.015	-0.006	-0.92	0.014	-0.0039	-0.61	0.01
Market return	b ₁	0.046	1.92		0.0486	1.67		0.0351	1.00	
Optimistic Sentiment	b ₂	0.0003	2.09		0.0003	2.45		0.0003	2.52	
Pessimistic sentiment	b ₃	-0.0003	-1.55		-0.0004	-1.77		-0.0004	-1.68	

Table 5
Momentum Profits Conditional on Investor Sentiment and Trading Volume

This table presents average monthly returns in percentages for price momentum strategies involving all NYSE/AMEX stocks for the time period April 1967 until December 2008. In Panel A the top 30% observations of this rolling average time series are the high sentiment periods, and the bottom 30% the low sentiment periods (20% in Panel B). The optimistic and pessimistic sentiment periods are identified as in Table 2. Panels A1 and B1 shows average monthly returns for the 30% most traded stocks in the sample, Panels A2 and B2 for the 40% middle group, and Panels A3 and B3 for the 30% least traded stocks. At the end of the formation period we rank stocks in deciles based on cumulative returns in the previous J months, as well as their average monthly turnover (total volume/shares outstanding) over the same period. We then form portfolios based on past returns and volume, which we hold for K months. To test whether momentum profits in each sentiment state respectively are equal to zero, we regress the time series of average monthly momentum profits for High, Middle and low volume groups separately on a Optimistic sentiment dummy variable and a Pessimistic sentiment dummy variable, with no intercept. To test if mean profits in Optimistic sentiment periods are different from profits in Pessimistic sentiment periods we regress average monthly momentum profits High, Middle and low volume groups separately on an Optimistic sentiment dummy variable with a constant. The t -statistics of the significance of momentum profits after optimistic and pessimistic sentiment in the volume portfolios, and the difference between profits derived after optimistic and pessimistic periods are calculated using Newey-West standard errors, where the lag is set to $K-1$. In this table $J, K=6$.

		Momentum Portfolio										Buy-Sell	[t-stat.]
		1=Sell	2	3	4	5	6	7	8	9	10=Buy		
Panel A: 30%-30% Sentiment states													
<i>Panel A1: High Vol.</i>													
Optimistic	(n=378)	-0.39	0.31	0.54	0.62	0.72	0.84	0.94	0.98	1.13	1.38	1.77	[6.48]
Pessimistic	(n=122)	0.40	0.96	1.10	1.10	1.11	1.11	1.10	1.05	1.07	1.15	0.75	[1.38]
											Opt.-Pes.	0.99	[1.58]
<i>Panel A2: Mid. Vol.</i>													
Optimistic	(n=378)	-0.08	0.59	0.84	0.89	1.00	1.04	1.09	1.17	1.34	1.66	1.75	[7.76]
Pessimistic	(n=122)	0.91	1.32	1.55	1.60	1.62	1.58	1.51	1.55	1.55	1.76	0.84	[2.11]
											Opt.-Pes.	0.91	[1.92]
<i>Panel A3: Low Vol.</i>													
Optimistic	(n=378)	0.23	0.63	0.88	1.00	1.11	1.17	1.25	1.34	1.49	1.66	1.43	[6.49]
Pessimistic	(n=122)	1.53	1.68	1.79	1.83	1.77	1.72	1.76	1.92	1.90	1.97	0.45	[0.95]
											Opt.-Pes.	1.17	[1.85]

Table 5, continued

		Panel B: 20%-20% Sentiment states												
		Momentum Portfolio												
		1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	[t-stat.]	
<i>Panel B1: High Vol.</i>														
Optimistic	(n=428)	-0.50	0.22	0.43	0.52	0.61	0.73	0.84	0.85	0.99	1.23	1.73	[7.08]	
Pessimistic	(n=72)	1.64	1.99	2.17	2.05	2.01	1.99	1.81	1.85	1.88	1.89	0.24	[0.30]	
											Opt.-Pes.	1.49	[1.73]	
<i>Panel B2: Mid. Vol.</i>														
Optimistic	(n=428)	-0.17	0.48	0.76	0.81	0.93	0.96	1.01	1.09	1.25	1.60	1.77	[8.38]	
Pessimistic	(n=72)	2.13	2.47	2.53	2.53	2.50	2.42	2.30	2.32	2.21	2.21	0.08	[0.15]	
											Opt.-Pes.	1.69	[2.80]	
<i>Panel B3: Low Vol.</i>														
Optimistic	(n=428)	0.20	0.58	0.84	0.97	1.07	1.12	1.21	1.33	1.47	1.63	1.42	[6.98]	
Pessimistic	(n=72)	2.58	2.65	2.62	2.60	2.49	2.38	2.34	2.38	2.30	2.40	-0.18	[-0.26]	
											Opt.-Pes.	1.60	[2.20]	

Table 6
Momentum Profits Conditional on Investor Sentiment and Firm Size

This table presents average monthly returns in percentages for price momentum strategies involving all NYSE/AMEX stocks for the time period April 1967 until December 2008. Panel A shows momentum strategies implemented on the 50% smallest companies in the sample and Panel B in the 50% largest. Size is measured as price x shares outstanding at the end of the formation period. Size decile breakpoints are from Kenneth French's data library. We allow one month between the end of the formation period and the holding period, and delete all stocks that are priced less than one \$1 at the beginning of the holding period. Sentiment is defined in Table 2. To test whether momentum profits in each sentiment state respectively are equal to zero, we regress the time series of average monthly momentum profits for small and large companies separately on an Optimistic sentiment dummy variable and a Pessimistic sentiment dummy variable, with no intercept. To test if mean profits in Optimistic sentiment periods are different from profits in Pessimistic sentiment periods we regress average monthly momentum profits for small and large companies separately on an Optimistic sentiment dummy variable with a constant. The *t*-statistics of the significance of momentum profits and the difference between profits derived after optimistic and pessimistic periods are calculated using Newey-West standard errors, where the lag is set to *K-1*. In this table *J, K=6*.

	Momentum Portfolio										Buy-Sell	[t-stat.]
	1=Sell	2	3	4	5	6	7	8	9	10=Buy		
Panel A: 30%-30% Sentiment states												
<i>Panel A1: Small Cap.</i>												
Optimistic (n=378)	-0.33	0.37	0.65	0.84	0.99	1.07	1.20	1.26	1.39	1.49	1.83	[7.80]
Pessimistic (n=122)	0.85	1.31	1.64	1.74	1.79	1.81	1.72	1.81	1.76	1.69	0.84	[1.92]
										Opt.-Pes.	0.99	[1.92]
<i>Panel A2: Large Cap.</i>												
Optimistic (n=378)	0.42	0.69	0.82	0.90	0.88	0.92	0.98	0.98	1.14	1.35	0.92	[3.98]
Pessimistic (n=122)	0.90	1.15	1.23	1.27	1.27	1.07	1.10	1.08	1.08	1.02	0.11	[0.23]
										Opt.-Pes.	0.81	[1.46]
Panel B: 20%-20% Sentiment states												
<i>Panel B1: Small Cap.</i>												
Optimistic (n=428)	-0.41	0.28	0.58	0.79	0.93	1.00	1.13	1.21	1.31	1.41	1.82	[8.58]
Pessimistic (n=72)	2.14	2.48	2.75	2.68	2.72	2.70	2.50	2.50	2.48	2.32	0.18	[0.29]
										Opt.-Pes.	1.64	[2.38]
<i>Panel B2: Large Cap.</i>												
Optimistic (n=428)	0.32	0.61	0.74	0.83	0.82	0.84	0.90	0.90	1.04	1.23	0.90	[4.29]
Pessimistic (n=72)	1.87	1.99	1.94	1.95	1.94	1.61	1.67	1.63	1.62	1.50	-0.37	[-0.60]
										Opt.-Pes.	1.27	[1.90]

Table 7
Risk-adjusted Momentum Profits Conditional on Investor Sentiment

This table presents risk adjusted momentum profits calculated from CAPM, Fama-French and Conditional CAPM models. For each momentum portfolio and holding period month we form a time series of returns, which we regress on excess market return when we risk adjust according to the CAPM, and excess market return, the SMB and HML factors when we risk adjust according to the Fama-French 3 factor model. For the CCAPM we allow beta to differ depending on the average sentiment in the 6 formation periods that correspond to each portfolio return observation (see equation 3). Using these loadings and the factor realizations in each month, we estimate the monthly excess return for each portfolio. The data on market returns, the risk free rate and the SMB and HML factors are from Kenneth French's data library. Sentiment is defined as in Table 2. To test whether momentum profits in each sentiment state respectively are equal to zero, we regress the time series of average monthly momentum profits on an Optimistic sentiment dummy variable and a Pessimistic sentiment dummy variable, with no intercept. To test if mean profits in Optimistic sentiment periods are different from profits in Pessimistic sentiment periods we regress average monthly momentum profits on an Optimistic sentiment dummy variable with a constant. The t-statistics of the significance of momentum profits and the difference between profits derived after optimistic and pessimistic periods are calculated using Newey-West standard errors, where the lag is set to $K-1$. In this table $J, K=6$.

	Momentum Portfolio										Buy-Sell	[t-stat.]
	1=Sell	2	3	4	5	6	7	8	9	10=Buy		
Panel A: 30%-30% Sentiment states												
<i>Panel A1: CAPM</i>												
Optimistic (n=378)	-0.57	0.10	0.41	0.53	0.66	0.73	0.82	0.86	0.98	1.12	1.69	[7.59]
Pessimistic (n=122)	0.28	0.79	1.03	1.10	1.10	1.10	1.05	1.05	0.96	0.91	0.63	[1.48]
										Opt.-Pes.	1.06	[2.09]
<i>Panel A2: FF</i>												
Optimistic (n=378)	-0.84	-0.15	0.15	0.29	0.44	0.51	0.61	0.66	0.80	0.97	1.81	[8.48]
Pessimistic (n=122)	-0.53	0.05	0.37	0.46	0.50	0.53	0.50	0.52	0.45	0.44	0.97	[2.43]
										Opt.-Pes.	0.84	[1.77]
<i>Panel A3: Conditional CAPM</i>												
Optimistic (n=378)	-0.56	0.11	0.41	0.54	0.67	0.73	0.82	0.86	0.99	1.12	1.68	[7.58]
Pessimistic (n=122)	0.24	0.69	0.92	0.98	0.99	1.00	0.96	0.98	0.91	0.87	0.63	[1.48]
										Opt.-Pes.	1.05	[2.08]

Table 7, continued.

	Momentum Portfolio										Buy-Sell	[t-stat.]
	1=Sell	2	3	4	5	6	7	8	9	10=Buy		
Panel B: 20%-20% Sentiment states												
<i>Panel B1: CAPM</i>												
Optimistic (n=428)	-0.58	0.08	0.38	0.52	0.64	0.71	0.80	0.84	0.94	1.08	1.67	[8.30]
Pessimistic (n=72)	0.96	1.41	1.61	1.58	1.55	1.47	1.34	1.28	1.17	0.99	0.03	[0.04]
										Opt.-Pes.	1.64	[2.38]
<i>Panel B2: FF</i>												
Optimistic (n=428)	-0.85	-0.19	0.11	0.26	0.40	0.47	0.57	0.63	0.75	0.93	1.79	[9.34]
Pessimistic (n=72)	-0.18	0.42	0.72	0.75	0.78	0.74	0.63	0.59	0.50	0.30	0.49	[0.83]
										Opt.-Pes.	1.30	[2.05]
<i>Panel B3: Conditional CAPM</i>												
Optimistic (n=428)	-0.58	0.09	0.39	0.53	0.64	0.71	0.80	0.84	0.95	1.09	1.66	[8.29]
Pessimistic (n=72)	0.88	1.22	1.40	1.35	1.35	1.28	1.17	1.15	1.07	0.91	0.02	[0.04]
										Opt.-Pes.	1.64	[2.37]

Table 8
Momentum Profits Conditional on an Alternative Investor Sentiment Index

This table presents average monthly returns in percentages for price momentum strategies involving all NYSE/AMEX stocks for the time period April 1967 until December 2005. We allow one month between the end of the formation period and the holding period, and delete all stocks that are priced less than one \$1 at the beginning of the holding period. Sentiment is measured using the monthly sentiment index constructed by Baker and Wurgler (2007), using trading volume (measured as total NYSE turnover), dividend premium, closed-end fund discount, number and first day returns in IPO's, and the equity share in new issues. Because these variables are partly related to economic fundamentals, Baker and Wurgler regress each proxy against growth in industrial production, real growth in durable, non-durable, and services consumption, growth in employment, and an NBER recession indicator, and use the residuals from this regression as the sentiment proxies. The overall sentiment index is the first principal component of the six sentiment proxies. In order to identify whether a particular formation period was optimistic or pessimistic we follow the same procedure as that outlined in Table 2. To test whether momentum profits in each sentiment state respectively are equal to zero, we regress the time series of average monthly momentum profits on an Optimistic sentiment dummy variable and a Pessimistic sentiment dummy variable, with no intercept. To test if mean profits in Optimistic sentiment periods are different from profits in Pessimistic sentiment periods we regress average monthly momentum profits on an Optimistic sentiment dummy variable with a constant. The t-statistics of the significance of momentum profits and the difference between profits derived after optimistic and pessimistic periods are calculated using Newey-West standard errors, where the lag is set to $K-1$. In this table $J, K=6$.

	Momentum Portfolio											
	1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	[t-stat.]
Panel A: 30%-30% Sentiment states												
Optimistic (n=346)	-0.16	0.46	0.74	0.86	0.96	1.02	1.08	1.11	1.20	1.32	1.49	[6.97]
Pessimistic (n=137)	1.82	2.04	2.09	2.07	1.98	1.96	1.99	2.04	2.19	2.44	0.62	[1.57]
										Opt.-Pes.	0.87	[2.01]
Panel B: 20%-20% Sentiment states												
Optimistic (n=397)	-0.04	0.58	0.85	0.97	1.06	1.11	1.17	1.23	1.33	1.49	1.54	[7.40]
Pessimistic (n=86)	2.45	2.39	2.36	2.26	2.11	2.08	2.08	2.07	2.15	2.33	-0.13	[-0.24]
										Opt.-Pes.	1.67	[2.83]

Table 9
Momentum Profits Conditional on Different Specifications of Investor Sentiment

This table presents average monthly returns in percentages for price momentum strategies involving all NYSE/AMEX stocks for the time period April 1967 until December 2008. We allow one month between the end of the formation period and the holding period, and delete all stocks that are priced less than one \$1 at the beginning of the holding period. Sentiment is defined in Table 2. In order to identify whether a particular formation period was optimistic or pessimistic, in each month t we calculate the average sentiment level for the previous 2 months. The top 30% (20% in Panel B) observations are the high sentiment periods, and the bottom 30% (20% in Panel B) the low sentiment periods. To identify each holding period month as optimistic and pessimistic, we calculate how many of the K formation periods that were used to select the stocks that are held that month were of high and low sentiment. If at least $2/3$ of these periods are low sentiment periods with the remaining $1/3$ being mild sentiment periods we classify the month as pessimistic. The rest are the optimistic sentiment months. To test whether momentum profits in each sentiment state respectively are equal to zero, we regress the time series of average monthly momentum profits on an Optimistic sentiment dummy variable and a Pessimistic sentiment dummy variable, with no intercept. To test if mean profits in Optimistic sentiment periods are different from profits in Pessimistic sentiment periods we regress average monthly momentum profits on an Optimistic sentiment dummy variable with a constant. The t-statistics of the significance of momentum profits and the difference between profits derived after optimistic and pessimistic periods are calculated using Newey-West standard errors, where the lag is set to $K-1$. In this table $J, K=6$.

		Momentum Portfolio											
		1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	[t-stat.].
		Panel A: 30%-30% Sentiment states											
Optimistic	(n=397)	-0.26	0.36	0.66	0.78	0.88	0.95	1.04	1.08	1.21	1.38	1.64	[8.07]
Pessimistic	(n=104)	1.61	1.93	2.04	2.03	2.03	1.98	1.96	1.98	1.95	1.98	0.36	[0.81]
											Opt.-Pes.	1.28	[2.62]
		Panel B: 20%-20% Sentiment states											
Optimistic	(n=446)	-0.08	0.52	0.80	0.91	1.01	1.08	1.16	1.22	1.32	1.44	1.53	[7.93]
Pessimistic	(n=55)	1.83	2.10	2.13	2.05	2.01	1.86	1.77	1.69	1.68	1.97	0.14	[1.73]
											Opt.-Pes.	1.39	[1.86]

Table 10
Momentum Profits Conditional on High, Mild and Low Investor Sentiment

This table presents average monthly returns in percentages for price momentum strategies involving all NYSE/AMEX stocks for the time period April 1967 until December 2008. We allow one month between the end of the formation period and the holding period, and delete all stocks that are priced less than one \$1 at the beginning of the holding period. Sentiment is defined in Table 2. In order to identify whether a particular formation period was optimistic or pessimistic, in each month t we calculate the average sentiment level for the previous 3 months. The top 30% (20% in Panel B) observations are the high sentiment periods, and the bottom 30% (20% in Panel B) the low sentiment periods. To identify each holding period month as optimistic and pessimistic, we calculate how many of the K formation periods that were used to select the stocks that are held that month were of high and low sentiment. If at least $2/3$ of these periods are low (high) sentiment periods with the remaining $1/3$ being mild sentiment periods we classify the month as pessimistic (optimistic). The rest are the 'mild' sentiment months. The t-statistics are simple t-statistics. In this table $J, K=6$.

	Momentum Portfolio											
	1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	[t-stat.]
Panel A: 30%-30% Sentiment States												
High sentiment (n=112)	-0.51	-0.09	0.18	0.37	0.59	0.66	0.82	0.84	1.06	1.43	1.94	[3.12]
Mild sentiment (n=266)	0.00	0.70	0.98	1.06	1.13	1.19	1.26	1.31	1.42	1.53	1.52	[5.61]
Low sentiment (n=122)	0.92	1.33	1.54	1.59	1.56	1.56	1.51	1.52	1.47	1.48	0.56	[1.23]
										Opt.-Pes.	1.42	[1.78]
Panel B: 20%-20% Sentiment States												
High sentiment (n=66)	-1.53	-0.91	-0.54	-0.30	-0.02	0.06	0.23	0.19	0.37	0.54	2.07	[2.07]
Mild sentiment (n=362)	0.01	0.63	0.89	0.99	1.07	1.13	1.21	1.28	1.38	1.56	1.55	[5.33]
Low sentiment (n=72)	2.14	2.41	2.55	2.47	2.42	2.33	2.20	2.17	2.10	2.04	-0.10	[-0.14]
										Opt.-Pes.	2.17	[1.78]

Table 11

Momentum Profits Conditional on UP Market States and on High, Mild and Low Investor Sentiment

This table presents average monthly returns in percentages for price momentum strategies involving all NYSE/AMEX stocks implemented after UP markets and conditioned according to optimistic, pessimistic and mild investor sentiment. Sentiment is defined as in Table 2. In Panel A (B) the top 30% (20%) observations of this rolling average time series are the optimistic sentiment periods, and the bottom 30% (20%) the pessimistic sentiment periods. The rest are the mild sentiment months. The state of the market is the return of the value weighted market index 36 month prior to beginning of the holding period, as measured by Cooper et al (2004). We allow one month between the end of the formation period and the holding period, and delete all stocks that are priced less than one \$1 at the beginning of the holding period. The t-statistics are adjusted for unequal variances. In this table $J, K=6$.

Momentum Portfolio												
Panel A: 30%-30% Sentiment States												
	1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	t-stat.
<i>Panel A2: UP market</i>												
<i>High sentiment</i> (n=103)	-0.42	0.11	0.42	0.57	0.8	0.86	1.01	1.07	1.3	1.73	2.15	[3.59]
<i>Mild sentiment</i> (n=242)	-0.21	0.58	0.88	0.97	1.08	1.14	1.2	1.24	1.35	1.43	1.65	[5.95]
<i>Low sentiment</i> (n=91)	0.39	0.88	1.15	1.2	1.22	1.22	1.15	1.21	1.21	1.19	0.80	[1.83]
										Opt.-Pes.	1.45	[1.82]
Panel B: 20%-20% Sentiment States												
<i>Panel B2: UP market</i>												
<i>High sentiment</i> (n=59)	-1.55	-0.73	-0.29	-0.11	0.21	0.29	0.47	0.46	0.65	0.9	2.46	[2.52]
<i>Mild sentiment</i> (n=326)	-0.18	0.5	0.79	0.89	0.99	1.05	1.12	1.19	1.31	1.49	1.67	[7.38]
<i>Low sentiment</i> (n=51)	1.81	2.23	2.42	2.37	2.33	2.26	2.1	2.11	2.07	1.88	0.07	[0.11]
										Opt.-Pes.	2.39	[2.04]

Table 12
Long-run Profits of Momentum Portfolios Conditional on Investor Sentiment

This table presents long run event time returns for momentum portfolios formed after optimistic and pessimistic periods. J and K in this table are equal to 6. For each momentum portfolio we define an event period 13 months after the initial formation period. From this event date month onwards we estimate the average monthly return of this portfolio in the following 6 years. The final return of each portfolio is the geometric average of these monthly average profits. Panel A uses raw returns, Panel B CAPM adjusted returns and Panel C returns adjusted according to the Fama-French 3 factor model. Sentiment is defined as in Table 2. To test whether momentum profits in each sentiment state respectively are equal to zero, we regress the time series of average monthly momentum profits on an Optimistic sentiment dummy variable and a Pessimistic sentiment dummy variable, with no intercept. To test if mean profits in Optimistic sentiment periods are different from profits in Pessimistic sentiment periods we regress average monthly momentum profits on an Optimistic sentiment dummy variable with a constant. The t-statistics of the significance of long run returns and the difference between returns derived after optimistic and pessimistic periods are calculated using Newey-West standard errors, where the lag is set to $K-1$. In this table $K=6$.

		Momentum Portfolio										Buy-Sell	[t-stat.]
		1=Sell	2	3	4	5	6	7	8	9	10=Buy		
Panel A: 30%-30% Sentiment States													
<i>Panel A1: Raw</i>													
Optimistic	(n=305)	1.22	1.17	1.14	1.13	1.11	1.09	1.08	1.05	0.99	0.87	-0.34	[-5.96]
Pessimistic	(n=116)	1.27	1.38	1.38	1.37	1.37	1.34	1.34	1.31	1.32	1.25	-0.01	[-0.15]
											Opt.-Pes.	-0.33	[-3.35]
<i>Panel A2: CAPM</i>													
Optimistic	(n=305)	0.83	0.81	0.79	0.78	0.77	0.76	0.74	0.71	0.64	0.49	-0.34	[-5.85]
Pessimistic	(n=116)	0.81	0.96	0.98	0.97	0.98	0.95	0.95	0.90	0.90	0.79	-0.02	[-0.23]
											Opt.-Pes.	-0.30	[-3.18]
<i>Panel A3: FF</i>													
Optimistic	(n=305)	0.49	0.45	0.44	0.44	0.43	0.44	0.43	0.42	0.37	0.26	-0.22	[-3.89]
Pessimistic	(n=116)	0.29	0.47	0.52	0.54	0.57	0.56	0.57	0.54	0.55	0.45	0.17	[2.28]
											Opt.-Pes.	-0.39	[-4.35]

Table 12, continued

		Momentum Portfolio										Buy-Sell	[t-stat.]
		1=Sell	2	3	4	5	6	7	8	9	10=Buy		
Panel B: 20%-20% Sentiment states													
<i>Panel B1: Raw</i>													
Optimistic	(n=352)	1.22	1.17	1.14	1.12	1.11	1.09	1.07	1.04	0.98	0.86	-0.36	[-5.92]
Pessimistic	(n=69)	1.27	1.38	1.38	1.38	1.38	1.35	1.35	1.33	1.35	1.27	-0.00	[-0.00]
											Opt.-Pes.	-0.36	[-3.50]
<i>Panel B2: CAPM</i>													
Optimistic	(n=352)	0.83	0.81	0.79	0.78	0.77	0.76	0.73	0.70	0.63	0.49	-0.35	[-5.81]
Pessimistic	(n=69)	0.81	0.95	0.97	0.98	0.98	0.95	0.95	0.92	0.92	0.81	-0.00	[-0.03]
											Opt.-Pes.	-0.35	[-3.42]
<i>Panel B3: FF</i>													
Optimistic	(n=352)	0.42	0.40	0.39	0.39	0.40	0.39	0.39	0.37	0.31	0.21	-0.22	[-3.84]
Pessimistic	(n=69)	0.25	0.43	0.48	0.51	0.54	0.53	0.55	0.53	0.54	0.45	0.20	[2.73]
											Opt.-Pes.	-0.40	[-4.51]

Table 13

Long run event time returns for momentum portfolios formed after periods of high, medium, and low sentiment.

The variables J and K in this table are equal to six years. For each momentum portfolio we define an event period starting in month $t+13$ where month t is the beginning of the initial formation period month. From this month onwards we estimate the average monthly return of this portfolio in the following six years. The final return of each portfolio is the geometric average of these monthly average profits. Panel A uses raw returns, Panel B CAPM-adjusted returns, and Panel C returns adjusted according to the Fama-French three-factor model. Sentiment is defined as in Table 2. In order to identify whether a particular formation period was optimistic or pessimistic, in each month t we calculate the average sentiment level for the previous three months. The top 30% (20% in Panel B) observations are the high sentiment periods, and the bottom 30% (20% in Panel B) the low sentiment periods. To identify each holding period month as optimistic and pessimistic, we calculate how many of the K formation periods that were used to select the stocks that are held that month were of high and low sentiment. If at least two-thirds of these periods are low (high) sentiment periods with the remaining 1/3 being mild sentiment periods we classify the month as pessimistic (optimistic). The rest are the ‘mild’ sentiment months. The t -statistics are simple t -statistics. In this table $J=6$.

		Momentum Portfolio											
		1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	
		Panel A: 30%-30% Sentiment States											
Panel A1: Raw													
Optimistic	($n=90$)	1.10	1.00	0.96	0.94	0.92	0.90	0.85	0.83	0.76	0.63	-0.47	
Middle	($n=215$)	1.27	1.24	1.22	1.20	1.19	1.18	1.17	1.14	1.09	0.97	-0.29	
Pessimistic	($n=116$)	1.27	1.38	1.38	1.37	1.37	1.34	1.34	1.31	1.32	1.25	-0.01	
											Opt.-Pes.	-0.46	
											t-stat	-7.37	
Panel A2: CAPM													
Optimistic	($n=90$)	1.01	0.90	0.86	0.83	0.81	0.79	0.75	0.73	0.66	0.54	-0.47	
Middle	($n=215$)	0.76	0.77	0.77	0.76	0.76	0.74	0.73	0.70	0.63	0.47	-0.29	
Pessimistic	($n=116$)	0.81	0.96	0.98	0.97	0.97	0.95	0.94	0.90	0.90	0.79	-0.02	
											Opt.-Pes.	-0.45	
											t-stat	7.06	
Panel A3: FF													
Optimistic	($n=90$)	0.58	0.46	0.42	0.42	0.41	0.40	0.38	0.38	0.33	0.25	-0.32	
Middle	($n=215$)	0.45	0.45	0.44	0.45	0.46	0.46	0.46	0.43	0.39	0.27	-0.18	
Pessimistic	($n=116$)	0.29	0.47	0.52	0.54	0.57	0.56	0.57	0.54	0.55	0.45	0.17	
											Opt.-Pes.	-0.49	
											t-stat	8.02	

Table 13, continued

		Momentum Portfolio										
		1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell
Panel B: 20%-20% Sentiment States												
<i>Panel B1: Raw</i>												
Optimistic	(n=50)	1.31	1.17	1.10	1.05	1.01	0.96	0.90	0.87	0.79	0.67	-0.64
Middle	(n=302)	1.23	1.22	1.19	1.18	1.17	1.16	1.15	1.12	1.08	0.98	-0.25
Pessimistic	(n=69)	1.17	1.34	1.36	1.36	1.36	1.33	1.34	1.30	1.30	1.16	-0.01
											Opt.-Pes.	-0.65
											t-stat	-8.83
<i>Panel B2: CAPM</i>												
Optimistic	(n=50)	1.25	1.09	1.00	0.96	0.92	0.86	0.81	0.79	0.71	0.60	-0.65
Middle	(n=302)	0.76	0.77	0.77	0.76	0.76	0.75	0.73	0.70	0.65	0.51	-0.24
Pessimistic	(n=69)	0.83	1.03	1.06	1.06	1.07	1.04	1.05	1.00	0.71	0.60	-0.01
											Opt.-Pes.	-0.64
											t-stat	8.75
<i>Panel B3: FF</i>												
Optimistic	(n=50)	0.58	0.46	0.42	0.40	0.39	0.36	0.34	0.33	0.27	0.18	-0.39
Middle	(n=302)	0.46	0.46	0.45	0.46	0.47	0.46	0.46	0.44	0.41	0.31	-0.14
Pessimistic	(n=69)	0.21	0.46	0.52	0.56	0.60	0.59	0.62	0.59	0.58	0.43	0.21
											Opt.-Pes.	-0.60
											t-stat	8.20