

# **Do Institutional Investors and Security Analysts Mitigate the Effects of Investor Sentiment?**

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## **Do Institutional Investors and Security Analysts Mitigate the Effects of Investor Sentiment?**

Abstract: One of most significant empirical findings in the behavioral finance literature is that investor sentiment affects asset prices. However, the mechanism by which sentiment affects asset prices is not well understood. Individuals are widely believed to be more influenced by sentiment than other investors, and individual noise traders combined with limits to arbitrage could explain sentiment-driven mispricing in stocks. Another explanation for sentiment-driven mispricing is that sentiment affects all market participants. To explore these two possibilities, we investigate decisions made by institutional investors and security analysts. We find that institutional investors tend to increase holdings in, and analysts tend to issue buy recommendations for, firms with subjective values when sentiment is high, even though these firms exhibit lower subsequent stock returns. Furthermore, returns tests show that these decisions by institutional investors and analysts are associated with greater sentiment-related mispricing of stocks. Thus, although we find that sentiment-related mispricing is mitigated when institutional investors and analysts act against it, more often than not they fail to do so.

## 1. Introduction

One of most significant empirical findings in the behavioral finance literature is that investor sentiment affects asset prices. Early research documenting the impact of investor sentiment on asset prices includes the work of Shiller (1984), DeLong, Shleifer, Summers and Waldmann (1990) and Lee, Shleifer and Thaler (1991). More recent research by Baker and Wurgler (2006) presents evidence that the cross section of expected equity returns is significantly affected by the level of investor sentiment. In particular, Baker and Wurgler (2006) reports that shares of certain firms—those whose valuations are more subjective—are more affected by shifts in investor sentiment. As a result, when sentiment is high these firms tend to be overvalued and thus subsequent returns are relatively low. When sentiment is low, the results reverse and high subjectivity firms have relatively high subsequent returns.

Although Baker and Wurgler (2006) finds evidence of sentiment-driven mispricing, the mechanism by which sentiment affects asset prices is ambiguous. Mispricing can occur when either a subset of investors is affected by sentiment and there are limits to arbitrage or when the impact of sentiment is market wide so that no parties take a contrarian position in the stock. In the first case, the subset of investors, typically called noise traders, is assumed to be composed largely of individual investors. If noise traders have relatively concentrated holdings in stock with highly subjective values, and if there are limits to arbitrage for those stocks, then subsequent returns will move inversely with sentiment as Baker and Wurgler (2006) finds. According to this interpretation, although institutions might wish to trade against the mispricing, limits to arbitrage prevent that trading from fully offsetting the impact of the sentiment.<sup>1</sup>

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<sup>1</sup> It should be noted that this interpretation implies that the impact of sentiment should be decreasing over time, as French (2008) documents the decline in equity holdings of individual investors compared to institutions. At some

In the second case, sentiment is widespread in that it affects all classes of investors in the market, but that sentiment affects stocks with subjective values more strongly because the characteristics of those stocks make objective valuation more difficult. If sentiment is market-wide, then there would be no tendency for institutions to take contrarian positions. The objective of this study is to examine the extent to which “sophisticated” investors take contrarian positions, and whether their taking contrarian positions mitigates sentiment-related mispricing.

There is, however, a complication associated with this second interpretation. It is possible that institutional investors recognize the mispricing but attempt to ride a wave of overvaluation by trading with a bubble for at least part of the time as described by Brunnermeier and Nagel (2004). In that situation, institutional trading becomes more complex in that institutions first trade with the bubble before switching to take contrarian positions at the appropriate time to maximize their gains. We provide empirical tests designed to distinguish between the two mechanisms. In doing so, we also take account, as far as the data permit, the complexity introduced by the work of Brunnermeier and Nagel (2004).

Examining whether sentiment extends beyond individuals is important to both academic research and public policy. Regarding academic research, it further advances our empirical understanding of the impact of behavioral biases on asset prices by examining the source of those biases in greater detail. Regarding policy, it has implications for the regulation of financial markets. Following the financial crisis and market crash of 2007-2008, there were widespread calls for reform of financial market regulation, most notably a report by the U.S. Department of the Treasury (2009) addressing financial regulatory reform, that resulted in passage of the Dodd-Frank Wall Street Reform and Consumer Protection Act in July 2010. A central theme of the

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point, one would presume, that the impact of individual investors would become too small to move prices at the margin.

reform bill is consumer protection, which is consistent with the view that individual investors need added protection because they lack adequate information and the analytical skills necessary to make appropriate investment decisions. A finding that equity prices are influenced by the irrational behavior of individual investors alone would resonate with calls for increased regulatory protection for small investors. On the other hand, if the behavioral biases reported by Baker and Wurgler (2006) reflect the ebb and flow of sentiment market wide, then added protection of individual investors would not be warranted on this basis.

To compare the two mechanisms, we examine the source of the behavioral biases that Baker and Wurgler (2006) reports by developing tests that examine whether the effects of sentiment extend to institutional investors and security analysts. We study institutional investors because they are often thought to trade on information not available to noise traders (Chakravarty, 2001) and to be less subject to behavioral biases (e.g., Sias, 1996). As a result, their trading acts as a countervailing force to stock price movements driven by swings in individual investor (i.e., noise trader) sentiment. We study analysts because, presumably, they should be among the market participants least affected by sentiment. Their job is by its nature analytical, and production of their reports requires a detailed review of financial data and the construction of valuation models. Presumably, this analytical process would mitigate the effect of sentiment on their recommendations.

Using a broad sample of 38,734 firm-year observations during the period 1993-2007, we investigate whether institutional investors and security analysts are affected by investor sentiment. We begin by examining their decisions directly, i.e., whether institutional investors increase or decrease stock holdings and whether security analysts issue favorable or unfavorable stock recommendations. We find both institutional investors and security analysts fail to act

counter to the effects of sentiment. In particular, institutions tend to *increase* holdings in stocks with subjective values during times of high sentiment, and analysts on average issue *favorable* recommendations for these stocks—even though subsequent stock returns tend to be lower.

Ultimately, we seek to understand the extent to which sentiment-related decisions of institutional investors and security analysts affect stock prices. If, for example, institutional investors and security analysts act counter to the effects of sentiment on a particular firm by selling shares or issuing a sell recommendation, respectively, we expect sentiment-related mispricing to be mitigated. On the other hand, if institutional investors and security analysts fail to counter the effects of sentiment, then the sentiment-related mispricing is likely to persist.

As a benchmark, we replicate Baker and Wurgler (2006) by estimating cross-sectional regressions of subsequent excess returns on investor sentiment and firm characteristics that are associated with high subjectivity. Our results confirm the Baker and Wurgler (2006) finding that subsequent excess returns for high subjectivity firms are lower when investor sentiment is high.

We then examine whether the effect of investor sentiment on stock price is mitigated for high subjectivity firms when institutional investors sell shares. We find reduced evidence of mispricing when institutions decrease holdings. In particular, based on annual (quarterly) subsequent returns, sentiment-related mispricing is 10.53 (1.69) percentage points greater when institutions increase holdings. Finally, we examine whether the effect of investor sentiment on stock price is mitigated for high subjectivity firms when analysts issue sell recommendations. We find that the effect of investor sentiment is more pronounced for stocks that have buy recommendations, which is consistent with the hypothesis that analyst recommendations contribute to the mispricing of stocks with subjective valuations during times of high sentiment.

Specifically, based on annual (quarterly) subsequent returns, sentiment-related mispricing is 10.81 (3.71) percentage points greater for stocks that have buy recommendations.

Taken together, our findings suggest that sentiment affects the decisions of not only individual noise traders but also informed market participants. Although we find evidence that when institutions and analysts act counter to sentiment mispricing is mitigated, more often than not they fail to act in this fashion. Our results do not completely rule out the possibility that limits to arbitrage play a role in sentiment-related mispricing. However, our results do indicate that at least some of the sentiment effect results from actions taken by institutions and security analysts.

## **2. Related literature**

Baker and Wurgler (2007, page 129) defines investor sentiment as “a belief about future cash flows and investment risks that is not justified by the facts at hand.” Investor sentiment can be concentrated among a subset of investors with biased beliefs (e.g., noise traders), or it can be widespread. Black (1986), DeLong, Shleifer, Summers and Waldmann (1990), Daniel, Hirshleifer, and Subrahmanyam (1998), Barberis, Shleifer, and Vishny (1998), Barber, Odean and Zhu (2006) develop behavioral models that identify noise traders as a specific group of investors whose biases cause stock prices to diverge from fundamental values. Most often, the noise traders are associated with individual investors, as in Barber, Odean and Zhu (2006). In this case, mispricing persists because of unspecified limits to arbitrage. However, if the impact of sentiment is widespread, limits to arbitrage are not required to explain observed mispricing.

Several studies report evidence of aggregate market overpricing (underpricing) during periods of high (low) investor sentiment, which leads to predictable patterns of future returns

(Brown and Cliff, 2005; Baker and Wurgler, 2006, 2007; Lemmon and Portniaguina, 2006; Tetlock, 2007). Focusing on the cross-section of stock returns, a subset of the studies, including Baker and Wurgler (2006, 2007) and Lemmon and Portniaguina (2006), finds evidence consistent with the behavioral models by showing proxies for investor sentiment are negatively associated with subsequent returns particularly for firms that are difficult to value, with the presumption that the stocks of these firms are also more difficult to arbitrage. This includes small firms, high-growth firms, firms whose stocks have low institutional ownership, and firms with high intangible value. Lemmon and Portniaguina (2006), which focuses on small firm stocks and stocks with low institutional ownership, concludes that investor sentiment forecasts returns for such stocks in a manner consistent with the predictions of models based on noise-trader sentiment. Consistent with Lemmon and Portniaguina (2006), Brown and Cliff (2005) assumes that a subset of investors makes biased asset valuations, and that limits to arbitrage hinder the exploitation of asset mispricing.

Alternatively, one can interpret evidence of aggregate market mispricing relating to investor sentiment as being indirect evidence in support of widespread sentiment that affects all classes of investors in the market, as in Akerlof and Shiller (2009). Regarding the cross-section of stock returns, instead of limits to arbitrage varying across firms, Baker and Wurgler (2006) posits it is possible that sentiment drives the relative demand for stocks. That is, stocks with subjective values are overpriced during times of high sentiment not because of limits to arbitrage but because there are no contrarians to drive the price down.

Whether the effects of sentiment extend beyond individuals to institutional investors and security analysts remains undetermined, although some recent research touches on the question. Hribar and McInnis (2009) concludes that errors in earnings expectations explain a significant



portion of the sentiment-driven future returns observed by Baker and Wurgler (2006). That is, when sentiment is high, analysts' earnings forecasts are relatively more optimistic for stocks with subjective values. However, with respect to stock recommendations, Hribar and McNinnis (2009) finds that analysts do not issue more favorable recommendations for stocks with subjective values when sentiment is high, concluding that analyst recommendations do not explain the relation between sentiment and stock returns. Bagnoli, Clement, Crawley, and Watts (2009) finds the opposite result; analysts on average do issue more favorable stock recommendations when recent or future investor sentiment is high. In contrast to the approach adopted in these two studies, we examine not only whether recommendations are favorable when sentiment is high but also the magnitude of sentiment-driven mispricing related to favorable recommendations.<sup>2</sup>

Related to institutional ownership, Lemmon and Portniaguina (2006) finds that stocks with low institutional ownership exhibit relatively lower (higher) returns following periods of high (low) sentiment, which is measured using consumer confidence. Lemmon and Portniaguina (2006) concludes that stocks held predominantly by individual investors are more prone to mispricing arising from changes in sentiment. We, in contrast, focus on the change in institutional ownership to determine whether institutional investors mitigate sentiment-related mispricing by trading counter to sentiment. Moreover, we are not aware of any study that examines directly the investment decisions by institutions relating to investor sentiment.

Finally, there is a substantial literature that investigates the general question of whether institutional investors are subject to a variety of proposed behavioral biases. Examples of this

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<sup>2</sup> Bagnoli, Clement, Crawley, and Watts (2009) also examines the profitability of analysts' recommendations but focuses on various characteristics related to the recommendation (e.g., boldness relative to other analysts) rather than whether the recommendations are buy or sell. Moreover, the focus of that study is on analysts' relative performance rather than whether firms are over- or under-valued as a function of analysts' recommendations.

line of research include Nofsinger and Sias (1999) and Sias (2004) who find that institutions deliberately herd in and out of stocks. In addition, Grinblatt, Titman, and Wermers (1995), Badrinath and Wahal (2002), Griffin, Harris, and Topaloglu (2003), and Temin and Voth (2004) provide evidence that institutions rely heavily on momentum-style strategies. Our work is more focused in that we specifically investigate whether the investment sentiment documented by Baker and Wurgler (2006) also affects institutional investors or whether they trade to offset that sentiment, as rational asset pricing models would predict.

### **3. Research Design**

#### *3.1 Analyst Recommendations and Institutional Holdings Tests*

We test whether sentiment affects institutional investors and analysts by examining the choices they make in response to changes in sentiment. If institutions are not swayed by the tide of sentiment that leads individuals to drive up the price of stocks with subjective values during times of high sentiment, they should decrease their holdings in these stocks. If institutions decrease their holdings in high-subjectivity stocks when sentiment is high, we expect a relative increase in holdings of low-subjectivity stocks. Thus, during times of high sentiment, we compare (via a two-sample t-test) the mean change in institutional ownership of high-subjectivity stocks and low-subjectivity stocks.

We also conduct a parallel set of tests for analysts. If analysts are not swayed by sentiment, they will issue less favorable recommendations for stocks with subjective values when sentiment is high.

#### *3.2 Subsequent Returns Tests*

Our returns tests are based on the framework of Baker and Wurgler (2006), which examines the relation between investor sentiment and abnormal stock returns in the subsequent

year. Baker and Wurgler (2006) predicts that when investor sentiment is high, uninformed demand shocks in the presence of binding arbitrage constraints lead to overpricing and, thereby, lower subsequent abnormal stock returns as the mispricing is eventually corrected. Furthermore, this overpricing is concentrated in stocks with highly subjective valuations. These predictions lead us to the following equation, which we estimate cross-sectionally with standard errors clustered by firm and time:

$$RET_{i,t+1} = a_0 + a_1 SENT_t + a_2 SUBJ_{it} + a_3 SENT_t \times SUBJ_{it} + \varepsilon_{i,t+1} \quad (1)$$

*RET* is abnormal stock return, and *SENT* is a measure of investor sentiment used in Baker and Wurgler (2006). *SUBJ* is a measure of subjectivity of a firm's valuation that we construct from the ten subjectivity proxy variables examined in Baker and Wurgler (2006) (see section 4.2 below). *SUBJ* is ordered such that higher values represent greater subjectivity, and *SENT* and *SUBJ* are then ranked into quintiles and scaled between 0 and 1. Ranking and scaling helps to control for outliers and more importantly facilitate and economic interpretation of the results. *i* and *t* subscripts refer to firm and time period.

Based on Baker and Wurgler (2006), we expect  $a_3$  to be less than zero. That is, when investor sentiment is high, firms with subjective values are relatively overpriced and experience lower subsequent stock returns. Our study extends Baker and Wurgler (2006) to examine whether sentiment-related decisions by institutional investors and analysts affect stock prices. To do this, for institutional investors, we estimate equation (1) for the subsample of observations with increases and decreases in institutional holdings. In the case of analysts, we divide the sample into stocks for which analysts issue buy (strong buy, buy) and sell (hold, sell, and strong sell) recommendations.

If institutions act counter to sentiment and this mitigates the overpricing of subjectively valued firms, then abnormal returns on these stocks should be less pronounced when institutional ownership decreases. That is,  $a_3$  should be less negative when institutional ownership decreases than when institutional ownership increases. With respect to analysts, if unfavorable recommendations mitigate the mispricing of stocks with subjective valuations during time of high sentiment, we predict  $a_3$  to be less negative when analysts issue sell recommendations than when they do not. As a corollary, during times of high sentiment, the subsequent returns to stocks with subjective values are even more negative when analysts recommend buying the stock. In other words, during times of high sentiment, analysts contribute to the mispricing by recommending stocks with subjective values.

We test our predictions regarding institutional investors by estimating an extended version of equation (1) that interacts the regressors with an indicator variable,  $INCR\_INST$ , which equals one if the percentage of shares held by institutional investors increases from the prior year, and zero otherwise.

$$RET_{i,t+1} = b_0 + b_1 SENT_t + b_2 SUBJ_{it} + b_3 SENT_t \times SUBJ_{it} + b_4 INCR\_INST_{it} + b_5 INCR\_INST_{it} \times SENT_t + b_6 INCR\_INST_{it} \times SUBJ_{it} + b_7 INCR\_INST_{it} \times SENT_t \times SUBJ_{it} + \varepsilon_{i,t+1} \quad (2)$$

Based on our prediction that investor sentiment affects subsequent returns for stocks with increases in institutional holdings more, we expect  $b_7$  in equation (2) to be negative. Similarly, we test our predictions regarding analysts by estimating an extended version of equation (1) that interacts the regressors with an indicator variable,  $BUY$ , which equals one if the consensus (mean) analyst recommendation is either buy or strong buy, and zero otherwise.

$$RET_{i,t+1} = b_0 + b_1 SENT_t + b_2 SUBJ_{it} + b_3 SENT_t \times SUBJ_{it} + b_4 BUY_{it} + b_5 BUY_{it} \times SENT_t + b_6 BUY_{it} \times SUBJ_{it} + b_7 BUY_{it} \times SENT_t \times SUBJ_{it} + \varepsilon_{i,t+1} \quad (3)$$

Based on our prediction that  $a_3$  is more negative for buy recommendations, we expect  $b_7$  in equation (3) to be less than zero.

For the sake of parsimony, we do not report regression summary statistics from equations (2) and (3), but rather use the negative significance of  $b_7$  to assess whether  $a_3$  is more negative for stocks with increases in institutional ownership and for buy recommendations.

## **4. Sample and Data**

### *4.1 Sample Selection*

Our sample begins with all observations included in Compustat between 1993 and 2007. We require data available to calculate subjectivity, then we match these observations to CRSP and require stock returns for the subsequent year, as well as market value of equity and stock return volatility, which are also used to calculate subjectivity. Finally, we exclude small firms with market capitalization less than \$100 million. The application of these selection criteria leads to a sample of 38,720 firm-year observations, of which 34,793 have available institutional ownership data from Thomson-Reuters and 29,723 have data from I/B/E/S to calculate a consensus stock recommendation.

### *4.2 Variable Measurement*

#### *Annual Data*

We measure our variables following the research design of Baker and Wurgler (2006). *SENT* is the investor sentiment index, as calculated from Eq. (3) in Baker and Wurgler (2006). The index combines six sentiment proxies: the closed-end fund discount, trading volume as measured by NYSE turnover, the number and average of first-day returns on IPOs, the equity share in new issues, and the dividend premium. Specifically, the sentiment index is the first

principal component of the six proxies, each of which having been standardized and orthogonalized with respect to a set of macroeconomic conditions. We calculate *SENT* as the monthly average over the firm's fiscal year.<sup>3</sup>

Baker and Wurgler (2006, Table 5) examines ten measures of subjectivity. We use the ten measures to construct a single subjectivity measure using factor analysis. Untabulated results support our use of a single factor—only one eigenvalue exceeds 1 (1.95; the second largest eigenvalue was only 0.41). Furthermore, each of the ten input variables is correlated in the predicted direction with the resulting factor, with Spearman correlations ranging from 0.15 (the absolute deviation of sales growth from the mean) to 0.74 (both stock volatility and dividends).

We obtain data on institutional ownership from the Thomson-Reuters Institutional Holdings Database, which provides common stock holdings (as reported quarterly on Form 13F) of institutions with \$100 million or more in assets under management. We calculate institutional ownership on June 30 of each year as the percentage of shares outstanding held by institutions. We measure change in institutional ownership as the annual difference. In addition, because there is a general upward secular trend in institutional ownership, the measure we use in our analyses is the change in institutional ownership less the average change in institutional ownership during the same year.

We obtain analysts' recommendations from I/B/E/S. We begin by isolating for each firm the most recent recommendation issued by each analyst during the first six calendar months of each year. Next, we compute the mean recommendation across analysts for each firm-year, with strong buy = 5, buy = 4, hold = 3, sell = 2, and strong sell = 1. We classify mean recommendations greater than or equal to four as buy recommendations. All others are

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<sup>3</sup> We obtained the monthly investor sentiment index from Jeffrey Wurgler's website, <http://pages.stern.nyu.edu/~jwurgler/>.

considered to be sell recommendations. To help ensure the mean is more heavily tilted toward recent forecasts, we weight forecasts by their age in months so that older forecasts receive less weight than recent ones.

Finally, *RET* is the annual stock return, less the mean return for stocks with similar size, book-to-market ratio, and momentum. To calculate mean portfolio returns, following Daniel et al. (1997), we first sort firms into quintiles according to market value of equity, book-to-market ratio (if positive; we group stocks with negative book equity into a sixth portfolio), and raw stock performance over the previous year. This procedure results in 150 ( $= 5 \times 6 \times 5$ ) portfolios. We include delisting returns according to the method described in Beaver, McNichols, and Price (2007), and we winsorize the extreme one percentiles.

Table 1, panels A and B, presents sample descriptive statistics and correlations. Panel A reveals that institutional holdings increase in 43% of observations, and 46% of stocks in the sample have buy or strong buy recommendations. Panel B indicates significantly positive correlations between sentiment and consensus recommendations, and a significantly positive Spearman correlation between sentiment and the change in institutional ownership. That is, when sentiment is high, institutional owners tend to increase holdings and analysts tend to issue more favorable recommendations. Furthermore, panel B reveals negative correlations between sentiment and subsequent returns, and between subjectivity and subsequent returns. However, we base our inferences on the multivariate tests that indicate whether returns are even lower for firms with subjective values when sentiment is high.

### *Quarterly Data*

To provide more precise evidence on the behavior of institutional investors and analysts and its timing with respect to mispricing and subsequent returns, we replicate our primary tests using quarterly data. The variables are constructed similar across annual and quarterly implementations, with the following exceptions.<sup>4</sup>

First, we calculate *SENT* as the monthly average over the fiscal quarter. In addition, we measure the ten measures of subjectivity using quarterly data from Compustat. We calculate the change in institutional ownership as the change in percentage of shares held from the beginning of the quarter to the end of the quarter. For fiscal quarters not ending in March, June, September, or December (i.e., the months in which Form 13F data are reported), we use Form 13F data from one or two months prior, as appropriate. We measure the consensus analyst forecast using the most recent recommendation issued by each analyst during the fiscal quarter. Finally, *RET* is the quarterly stock return, which we measure beginning one day after the current fiscal quarter end through the end of the following fiscal quarter.

## **5. Findings**

### *5.1 Institutional Holdings and Analyst Recommendations*

Table 2 presents the results of the tests described in Section 3.1 for changes in institutional ownership for high- and low-subjectivity stocks in markets characterized by high sentiment (i.e., above the sample median). Panels A and B present results using annual and quarterly data.

Table 2, panel A, indicates that institutions fail to decrease holdings in stocks with subjective values when sentiment is high. Column 1 reveals that the mean annual change in

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<sup>4</sup> Untabulated descriptive statistics and correlations relating to quarterly data reveal similar inferences to those based on annual data in table 1.



institutional ownership is positive, 0.47%, and significantly higher (t-statistic = 2.23) than the change in ownership for low-subjectivity stocks, -0.56%. Results in panel B based on quarterly data are similar, except for smaller magnitudes that are expected for changes measured over a shorter time period. When sentiment is high, institutions increase ownership significantly more (t-statistic = 2.74) in high-subjectivity stocks on average, 0.15%, more than low-subjectivity stocks (-0.14%).<sup>5</sup>

Although these findings suggest institutional investors are also affected by investor sentiment, Brunnermeier and Nagel (2004) offers an alternative explanation—that institutional investors actively ride sentiment-induced trends. To investigate whether this is the case, we examine changes in institutional ownership and stock return in the subsequent year. Table 2, column 2, which presents mean changes in institutional ownership in the subsequent year (panel A) and quarter (panel B), reveal that institutions fail to decrease holdings in stocks with subjective values when sentiment is high in the subsequent year or quarter. If institutional investors were “riding the wave” of investor sentiment, then we would expect them to decrease holdings in anticipation of expected fall in stock prices. However, the mean change in institutional ownership in the subsequent quarter for high subjectivity stocks remains positive, 0.07%, and significantly higher (t-statistic = 1.73; one-tailed p-value = 0.042) than the change in ownership for low-subjectivity stocks (-0.07%). Column 3 indicates that these changes in ownership occur when prices for high (low) subjectivity stocks fall 1.35% (rise 0.22%). The findings based on annual data indicate that the mean subsequent changes in ownership for high and low subjectivity stocks do not differ (t-statistic = 0.14), despite the significantly greater fall

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<sup>5</sup> Untabulated findings reveal a significantly greater increase in holdings of stocks with subjective values during high sentiment when change in institutional ownership is measured without a year-mean adjustment or using a constant set of institutions from the beginning to the end of the holding period.

in stock prices (t-statistic = 2.33) for high-subjectivity stocks,  $-5.85\%$ , than for low-subjectivity stocks,  $-1.86\%$ .<sup>6</sup>

Turning to security analysts, the findings relating to annual data in Table 3, panel A, indicate that analysts on average issue significantly more favorable recommendations for high-subjectivity stocks (3.89) than for low-subjectivity stocks (3.77) when sentiment is high (t-statistic = 3.88). Findings based on quarterly data in panel B reveal similar results, i.e., analysts issue significantly more favorable recommendations for high-subjectivity stocks, 4.00, than for low-subjectivity stocks, 3.81, when sentiment is high (t-statistic = 8.08).

The findings for the analyst recommendations and stock return in the subsequent year mirror those relating to institutional holdings. In particular, analyst recommendations remain significantly higher in the subsequent year for high-subjectivity stocks than for low-subjectivity stocks (t-statistic = 3.75), despite the significantly greater fall in stock prices (t-statistic = 1.68; one-tailed p-value = 0.046) for high-subjectivity stocks,  $-5.21\%$ , than for low-subjectivity stocks,  $-2.31\%$ . The findings in the subsequent quarter are consistent with the annual findings, except the difference in subsequent-quarter stock return of high-subjectivity stocks,  $-0.90\%$ , and low-subjectivity stocks,  $0.05\%$ , is not statistically significant.

Taken together, the results in Tables 2 and 3 suggest that institutional investors and analysts are not immune from the effects of sentiment. Specifically, although returns on stocks with subjective values tend to be lower following periods of high sentiment, institutional investors increase holdings in these stocks and security analysts issue favorable

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<sup>6</sup> Although it is possible that institutional investors were able to time precisely when to stop riding the investor sentiment wave, to explain the subsequent-year increase we observe they would have had to decrease and then increase their holdings during the subsequent quarter and year when and if stock prices fell and rose. Although we do not have data necessary to conduct this analysis, this situation is unlikely to occur, especially given the quarterly findings where the institutional investors have even less time to sell and repurchase the stock.

recommendations. We next examine the potential implications of these sentiment-related decisions by institutional investors and analysts for stock prices.

### 5.2 *Replication of Baker and Wurgler (2006)*

Table 4, panels A and B, presents findings from estimation of equations (1) using annual and quarterly data, respectively. The findings support those in Baker and Wurgler (2006). In particular, the coefficient on the interaction of subjectivity and investor sentiment,  $a_3$ , is significantly negative (coefficient =  $-0.041$ , t-statistic =  $-2.33$ ; coefficient =  $-0.032$ , t-statistic =  $-6.11$ ; based on annual and quarterly data).

Although these findings confirm those in Baker and Wurgler (2006), as with that study, these findings do not enable us to determine whether the sentiment pricing effect is attributable solely to individuals or whether institutional investors and analysts also play a role. Therefore, we now turn to estimations of equation (1) that permit the sentiment pricing effect to vary for different levels of institutional investment holdings and for buy and sell analyst recommendations.

### 5.3 *Estimations Based on the Change in Institutional Ownership*

Table 5 presents findings from the estimation of equation (1) separately for stocks with increases and decreases in institutional holdings.<sup>7</sup> Based on the annual data in panel A, sentiment-related mispricing is greater when institutions increase holdings, i.e., when institutions fail to counter investor sentiment. In fact, when institutions “lean against the wind” by trading

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<sup>7</sup> It is possible that institutions buy stocks according to various predictors of subsequent returns. Although our measure of abnormal return already adjusts for size (Banz 1981), momentum (Jegadeesh and Titman 1993) and equity book-to-market ratio (Rosenberg et al. 1985 and Fama and French 1992), we also estimated additional (untabulated) specifications that include linear controls for accruals (Sloan 1996; Xie 2001), asset growth (Cooper, Gulen, and Schill 2008), profitability (Haugen and Baker 1996), and share issuance (Ikenberry et al. 1995 and Loughran and Ritter 1995). Inferences based on these untabulated findings are identical to those relating to tabulated findings.

counter to sentiment, there is no evidence of sentiment-related mispricing. In particular, the coefficient on the interaction of subjectivity and investor sentiment,  $a_3$ , is significantly more negative when institutional ownership increases,  $-0.098$ , than when it decreases,  $0.007$  (t-statistic = 2.80). Thus, based on annual stock returns, sentiment-related mispricing is 10.53 percentage points greater when institutions increase holdings. The findings based on the quarterly data in panel B are similar to those based on annual data, i.e.,  $a_3$ , is more negative when institutional ownership increases,  $-0.038$ , than when it decreases,  $-0.021$ , although the difference is insignificant (t-statistic = 1.53). Finding a significant difference based on annual data but not quarterly data suggests that differences in price reversals following high sentiment do not occur fully in the subsequent quarter.

#### 5.4 *Estimations Using Analysts' Buy and Sell Recommendation Partitions*

Table 6 presents the results from estimation of equation (1) separately for buy (strong buy and buy) and sell (hold, sell, and strong sell) recommendations. Based on annual data, for sell recommendations, the coefficient on the interaction of subjectivity and investor sentiment,  $\alpha_3$ , is not significantly negative (coefficient = 0.007, t-statistic = 0.28). Thus, the Baker and Wurgler (2006) finding that prices for stocks with subjective valuations decline when sentiment is high does not obtain for stocks for which analysts have issued sell or neutral stock recommendations. In contrast, for buy recommendations, the coefficient on the interaction of subjectivity and investor sentiment is significantly negative (coefficient =  $-0.101$ , t-statistic =  $-3.37$ ). Thus, based on subsequent annual returns, sentiment-related mispricing is 10.81 percentage points greater for stocks that have buy recommendations. In addition, the coefficient estimate for firms with buy recommendations is significantly more negative than that of sell recommendations (t-statistic = 2.70).

The findings based on the quarterly data in panel B are consistent with those based on annual data. In particular,  $a_3$ , is negative for buy recommendations,  $-0.037$ , and essentially zero for sell recommendations. The difference is statistically significant (t-statistic = 2.68).

Collectively, these findings suggest that analysts' favorable recommendations potentially contribute to the mispricing of stocks with subjective valuations during time of high sentiment. It is also possible that analysts merely "follow the crowd" and make stock recommendations that reflect existing investor sentiment. Because we do not explicitly test for causality, we do not distinguish between these two potential explanations in this study. However, the evidence does suggest that whether or not analysts initially cause sentiment-related overpricing, they can help correct it by issuing a sell recommendation.

## **6. Summary and Concluding Remarks**

One of the fundamental propositions of behavioral finance is that investor sentiment affects asset prices. Baker and Wurgler (2006) supports this proposition by finding evidence that the cross section of expected equity returns is significantly related to the level of investor sentiment. There are two possible sources of investor sentiment that can explain this finding. One is that the impact of sentiment is limited to noise traders, usually identified as individuals, but affects asset prices because of limits to arbitrage. The other is that the impact of sentiment is market wide.

Our results support the view that the impact of sentiment is not limited to individual investors. Our findings indicate that sentiment also affects both institutional investors and security analysts, which implies that the failure of these sophisticated parties to "lean against the wind" and correct sentiment-related mispricing is not attributable solely to limits to arbitrage.

Our findings do not rule out the possibility that the action of individual noise traders is a pathway through which sentiment affects asset prices. However, our results are inconsistent with the hypothesis that this is the sole source of the sentiment-based bias in asset prices.

Our findings have implications for the regulation of financial markets. One aspect of the current financial market regulatory reform is that individual investors need added protection because they lack adequate information and the analytical skills necessary to make appropriate investment decisions. Based on our finding that equity prices are influenced by the ebb and flow of sentiment on a market-wide basis, the added protection of individual investors might not serve the regulation's intended purpose.

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**Table 1: Descriptive Statistics***Panel A: Summary Statistics*

	<i>N</i>	<i>Mean</i>	<i>St Dev</i>	<i>Q1</i>	<i>Median</i>	<i>Q3</i>		
<i>SENT</i>	38,720	0.50	0.36	0.25	0.50	0.75		
<i>SUBJ</i>	38,720	0.50	0.35	0.25	0.50	0.75		
<i>SENT</i> × <i>SUBJ</i>	38,720	0.27	0.30	0.00	0.19	0.50		
<i>RET</i>	38,720	-0.03	0.44	-0.29	-0.07	0.18		
$\Delta$ <i>INST</i>	34,753	0.00	0.12	-0.05	-0.01	0.04	Incr.:	43%
<i>REC</i>	29,723	3.78	0.73	3.20	3.85	4.25	Buy:	46%

*Panel B: Pearson (above diagonal) and Spearman (below diagonal) Correlations*

	<i>SENT</i>	<i>SUBJ</i>	<i>SENT</i> × <i>SUBJ</i>	<i>RET</i>	$\Delta$ <i>INST</i>	<i>REC</i>
<i>SENT</i>		<b>0.13</b>	<b>0.68</b>	<b>-0.04</b>	0.00	<b>0.08</b>
<i>SUBJ</i>	<b>0.13</b>		<b>0.68</b>	<b>-0.06</b>	<b>0.08</b>	<b>0.10</b>
<i>SENT</i> × <i>SUBJ</i>	<b>0.68</b>	<b>0.68</b>		<b>-0.07</b>	0.04	<b>0.11</b>
<i>RET</i>	<b>-0.04</b>	<b>-0.13</b>	<b>-0.10</b>		0.00	0.01
$\Delta$ <i>INST</i>	<b>0.01</b>	<b>0.08</b>	<b>0.06</b>	-0.01		<b>0.14</b>
<i>REC</i>	<b>0.08</b>	<b>0.10</b>	<b>0.12</b>	0.00	<b>0.15</b>	

- SENT* The average of monthly investor sentiment values (Baker and Wurgler 2006) over the fiscal year, ranked into quintiles and scaled between 0 and 1.
- SUBJ* Subjectivity of the firm's valuation (index created from factor analysis of the 10 variables used in Baker and Wurgler 2006), ranked into quintiles and scaled between 0 and 1.
- RET* Subsequent year stock return, adjusted for size, book-to-market, and momentum.
- $\Delta$ *INST* Change in institutional ownership from prior year, less the average change across all firms in the same year.
- REC* Consensus recommendation; from 1 (strong sell) to 5 (strong buy).

Correlations significantly different from zero at the 0.05 level are shown in bold.

**Table 2: Examination of Changes in Institutional Ownership of High vs. Low Subjectivity Firms when Investor Sentiment is High**

*Panel A: Annual Data*

<i>SUBJ</i> [ <i>t</i> ]	N	(1) Mean $\Delta INST$ [ <i>t</i> ]	(2) Mean $\Delta INST$ [ <i>t</i> +1]	(3) Mean <i>RET</i> [ <i>t</i> +1]
LOW	8,001	-0.56%	0.12%	-1.86%
HIGH	9,917	0.47%	0.00%	-5.85%
t-stat  for difference in mean:		2.23	0.14	2.33

*Panel B: Quarterly Data*

<i>SUBJ</i> [ <i>q</i> ]	N	(1) Mean $\Delta INST$ [ <i>q</i> ]	(2) Mean $\Delta INST$ [ <i>q</i> +1]	(3) Mean <i>RET</i> [ <i>q</i> +1]
LOW	21,829	-0.15%	-0.07%	0.22%
HIGH	28,058	0.14%	0.07%	-1.35%
t-stat  for difference in mean:		2.74	1.73	2.63

- SUBJ* Subjectivity of the firm's valuation (index created from factor analysis of the 10 variables used in Baker and Wurgler 2006). LOW (HIGH) indicates subjectivity is below (above) the sample median.
- RET* Subsequent year/quarter stock return, adjusted for size, book-to-market, and momentum.
- ΔINST* Change in institutional ownership from prior year/quarter, less the average change across all firms in the same year/quarter.

t-statistics include a Newey-West (1987) adjustment.

**Table 3: Examination of Analyst Recommendations of High vs. Low Subjectivity Firms when Investor Sentiment is High**

*Panel A: Annual Data*

<i>SUBJ</i> [ <i>t</i> ]	N	(1) Mean <i>REC</i> [ <i>t</i> ]	(2) Mean <i>REC</i> [ <i>t</i> +1]	(3) Mean <i>RET</i> [ <i>t</i> +1]
LOW	6,608	3.77	3.70	-2.31%
HIGH	8,189	3.89	3.77	-5.21%
t-stat  for difference in mean:		3.88	3.75	1.68

*Panel B: Quarterly Data*

<i>SUBJ</i> [ <i>q</i> ]	N	(1) Mean <i>REC</i> [ <i>q</i> ]	(2) Mean <i>REC</i> [ <i>q</i> +1]	(3) Mean <i>RET</i> [ <i>q</i> +1]
LOW	14,928	3.81	3.77	0.05%
HIGH	17,907	4.00	3.94	-0.90%
t-stat  for difference in mean:		8.08	5.60	1.45

- SUBJ* Subjectivity of the firm's valuation (index created from factor analysis of the 10 variables used in Baker and Wurgler 2006). LOW (HIGH) indicates subjectivity is below (above) the sample median.
- RET* Subsequent year/quarter stock return, adjusted for size, book-to-market, and momentum.
- REC* Consensus recommendation; from 1 (strong sell) to 5 (strong buy).

t-statistics include a Newey-West (1987) adjustment.

**Table 4: Replication of Baker and Wurgler (2006)**

$$RET_{i,t+1} = a_0 + a_1 SENT_t + a_2 SUBJ_{it} + a_3 SENT_t \times SUBJ_{it} + \varepsilon_{i,t+1}$$

*Panel A: Annual Data*

	<u>Pred.</u>	<u>Est.</u>	<u>t-stat</u>
Intercept		0.017	3.53
<i>SENT</i>		-0.014	-1.65
<i>SUBJ</i>		-0.055	-5.07
<i>SENT</i> × <i>SUBJ</i>	-	-0.041	-2.33
N		38,720	
R-squared		0.51%	

*Panel B: Quarterly Data*

	<u>Pred.</u>	<u>Est.</u>	<u>t-stat</u>
Intercept		0.002	1.57
<i>SENT</i>		0.015	6.31
<i>SUBJ</i>		-0.013	-4.43
<i>SENT</i> × <i>SUBJ</i>	-	-0.032	-6.11
N		106,882	
R-squared		0.31%	

- SENT* The average of monthly investor sentiment values (Baker and Wurgler, 2006) over the fiscal year/quarter, ranked into quintiles and scaled between 0 and 1.
- SUBJ* Subjectivity of the firm's valuation (index created from factor analysis of the 10 variables used in Baker and Wurgler 2006), ranked into quintiles and scaled between 0 and 1.
- RET* Subsequent year/quarter stock return, adjusted for size, book-to-market, and momentum.

Standard errors are clustered by firm and year/quarter.

**Table 5: Extension of Baker and Wurgler (2006) on Firms with Increases and Decreases in Institutional Ownership**

$$RET_{i,t+1} = a_0 + a_1 SENT_t + a_2 SUBJ_{it} + a_3 SENT_t \times SUBJ_{it} + \varepsilon_{i,t+1}$$

*Panel A: Annual Data*

		<i>Incr. in INST</i>		<i>Decr. in INST</i>	
	<u>Pred.</u>	<u>Est.</u>	<u>t-stat</u>	<u>Est.</u>	<u>t-stat</u>
Intercept		0.009	0.97	0.016	2.68
<i>SENT</i>		0.004	0.29	-0.016	-1.55
<i>SUBJ</i>		-0.013	-0.68	-0.078	-5.19
<i>SENT</i> × <i>SUBJ</i>	-	-0.098	-3.42	0.007	0.30
N		14,918		19,835	
R-squared		0.50%		0.42%	
t-stat  for diff. in a3 between <i>Incr./Decr. in INST</i> :				2.80	

*Panel B: Quarterly Data*

		<i>Incr. in INST</i>		<i>Decr. in INST</i>	
	<u>Pred.</u>	<u>Est.</u>	<u>t-stat</u>	<u>Est.</u>	<u>t-stat</u>
Intercept		0.000	0.12	0.002	1.37
<i>SENT</i>		0.016	4.12	0.013	4.18
<i>SUBJ</i>		-0.007	-1.37	-0.017	-3.97
<i>SENT</i> × <i>SUBJ</i>	-	-0.038	-4.52	-0.021	-2.85
N		44,622		54,185	
R-squared		0.25%		0.25%	
t-stat  for diff. in a3 between <i>Incr./Decr. in INST</i> :				1.53	

*SENT* The average of monthly investor sentiment values (Baker and Wurgler, 2006) over the fiscal year/quarter, ranked into quintiles and scaled between 0 and 1.

*SUBJ* Subjectivity of the firm's valuation (index created from factor analysis of the 10

variables used in Baker and Wurgler 2006), ranked into quintiles and scaled between 0 and 1.

*RET* Subsequent year/quarter stock return, adjusted for size, book-to-market, and momentum.

*Incr. (Decr.) in INST* indicates stocks with increases (decreases) in institutional ownership during the year/quarter. Standard errors are clustered by firm and year/quarter.

**Table 6: Extension of Baker and Wurgler (2006) on Firms with Consensus Buy and Sell Recommendations**

$$RET_{i,t+1} = a_0 + a_1 SENT_t + a_2 SUBJ_{it} + a_3 SENT_t \times SUBJ_{it} + \varepsilon_{i,t+1}$$

*Panel A: Annual Data*

		<b>BUY</b>		<b>SELL</b>	
	<u>Pred.</u>	<u>Est.</u>	<u>t-stat</u>	<u>Est.</u>	<u>t-stat</u>
Intercept		0.007	0.74	0.011	1.77
<i>SENT</i>		0.005	0.36	-0.019	-1.67
<i>SUBJ</i>		-0.006	-0.29	-0.062	-3.90
<i>SENT</i> × <i>SUBJ</i>	-	-0.101	-3.37	0.007	0.28
N		13,572		16,151	
R-squared		0.46%		0.29%	

|t-stat| for diff. in a3 between *BUY/SELL*: 2.70

*Panel B: Quarterly Data*

		<b>BUY</b>		<b>SELL</b>	
	<u>Pred.</u>	<u>Est.</u>	<u>t-stat</u>	<u>Est.</u>	<u>t-stat</u>
Intercept		0.002	0.74	0.001	0.70
<i>SENT</i>		0.011	2.34	0.009	2.32
<i>SUBJ</i>		0.001	0.23	-0.025	-4.85
<i>SENT</i> × <i>SUBJ</i>	-	-0.037	-3.68	0.000	0.01
N		32,230		33,119	
R-squared		0.17%		0.23%	

|t-stat| for diff. in a3 between *BUY/SELL*: 2.68

*SENT* The average of monthly investor sentiment values (Baker and Wurgler, 2006) over the fiscal year.

*SUBJ* Subjectivity of the firm's valuation (index created from factor analysis of the 10



variables used in Baker and Wurgler 2006), ranked into quintiles and scaled between 0 and 1.

*RET* Subsequent year stock return, adjusted for size, book-to-market, and momentum.

*BUY/SELL* indicates stocks with consensus buy (sell) recommendations during the year/quarter. Standard errors are clustered by firm and year. Firms with equity value less than \$100mm are excluded.