Title

Beyond Market Mood: Stock Sentiment and the Response to Corporate Earnings Announcements

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Abstract

Our research is novel in that it simultaneously considers both stock-specific investor sentiment and market-wide investor sentiment in the context of earnings announcements. It forms the basis of a deeper understanding of the mechanisms by which sentiment affects stock prices and its role in the price formation process. We make contributions to the existing literature in several areas. First, this study is the first to establish a relationship between stock-specific investor sentiment and stock price movements around earnings announcements. Second, we find that stock-specific investor sentiment is the key determinant of price adjustment in the context of a significant micro-event i.e. an earnings surprise. Third that the effect of stock-specific investor sentiment is not moderated by market-wide investor sentiment. Finally, we provide evidence that the effect of stock-specific investor sentiment is more pronounced for stocks that are hard to value and difficult to arbitrage.

Key words: Investor sentiment, social media, Twitter, StockTwits, earnings surprises, uncertainty, limits to arbitrage.

1. Introduction

The role of investor sentiment in investment decisions has been clearly established in the finance and accounting literature in recent years (see Baker and Wurgler (2006) for the merits of investment sentiment beyond the realms of classical finance theory). Similarly, the fact that internet stock messages and other social media may contain information or sentiment which influences price formation has also been established (Antweiler & Frank, 2004 and others). Finally, the existence of new types of investors and new investment processes has been clearly illustrated in the recent literature on high frequency trading and a new market microstructure has been documented by O'Hara (2015) and others. Our research combines elements of these disparate strands of finance theory to indicate the role of stock-specific investor sentiment in asset pricing. More specifically the role of investor sentiment in the presence of a corporate earnings surprise.

The pace of financial and technological change in recent decades has been so significant that many of the traditional methods of investment and investment analysis have been complemented or even replaced by new methods of collection and dissemination of price sensitive information including the analysis of textual sentiment and machine based learning. The explosive growth of social media and the harnessing of advanced computing resources means that it is now possible to incorporate both qualitative and quantitative analysis into the consideration of economically significant events. Such developments have allowed us to extend research into an important corporate event, an earnings announcement surprise, from the macro or market-wide proxies for investor sentiment used in the previous literature to a stock-specific or micro proxy for investor sentiment to capture the effect of stock-specific investor sentiment around the period of the announcement event.[1] Research so far has focused on these macro proxies to try to capture investor sentiment in order to establish a relationship between earnings announcements and abnormal returns within a defined event-window but we believe that these proxies are too general to give significant insight into price formation behaviour in the light of a corporate

[1] We use the terms micro or stock-specific sentiment and macro or market-wide sentiment interchangeably in the text as we differentiate between the mood of the broad market and investor sentiment as captured by social media for an individual company.

earnings announcement surprise and therefore use a stock-specific (micro) measure of investor sentiment.

The seismic changes in the equity market and the nature of market participants has been noted by researchers concerned with high-frequency trading (HFT) and market microstructure (See O'Hara (2015), Harris and Saad (2014) and Goldstein, Kumar, and Graves (2014) amongst others). Indeed these changes have been so rapid and so widespread that the Securities and Exchange Commission (SEC) (2010) sought consultation from market participants on equity market structure in order to assess 'whether market structure rules have kept pace with among other things, changes in trading technology and practices' pp3596.

With such high volumes of financial data being generated on a minute by minute basis and the high volumes of computer generated trading[2] based on the abilities of some traders to trade in microseconds the need for new market indicators has led some to look for electronic versions of the floor trading 'squawk box'. Harris and Saad (2014) find message traffic in electronic markets (which they label 'silent' sound) can indicate the short term direction of equity price changes. Goldstein and Yang (2015) update the work of Grossman and Stiglitz (1980) and conclude that the information available now is so complex that informed traders tend to specialize or have a comparative advantage in different types of financial information. With many traders seeking to gain advantages in technology, including co-location of trading computers at stock exchanges, attention has switched to new sources of information on sentiment. Goldstein et al. (2014) note that the search for methods to analyse and interpret this data has extended into the areas of textual sentiment and mood based sentiment indicators. Many algorithmic traders and hedge funds not only parse news with textual sentiment but also subscribe to commercial services which supply live textual sentiment feeds. We incorporate one such system into our research using market participants generated content from Twitter and StockTwits, where traders use 'cashtags' to flag stock-specific tweets.[3] Our research is novel in that it simultaneously

[2] HFT is estimated to account for more than 50% of all U.S. equity trading (Goldstein et al., 2014 and O'Hara, 2015).
[3] The Cashtag for Apple for example is $AAPL.

considers both stock-specific investor sentiment and market-wide investor sentiment. Our research forms the basis of a deeper understanding of the mechanisms by which sentiment affects stock prices and its role in the price formation process.

The importance of social media was highlighted by Antweiler and Frank (2004) who conclude that internet stock messages are not just 'noise'. Twitter and StockTwits have become vibrant online platforms for exchanging stock-related information with a surge in usage over the period under review as noted by Chen, De, Hu, and Hwang (2014). A vast number of tweets per day, generated by a huge number of active users, are dedicated to the discussion of public companies and the trading of stocks, providing an extensive real-time stream of investment information and investment ideas. We use the output of microblogging forums, Twitter and StockTwits, to measure daily investor sentiment about individual stocks over the 5-year period, 2011-2015. We analyse around 14,000 individual earnings announcement events where earnings announced diverge from investment analysts' forecasts. We advance research into investor sentiment by employing a measure of stock-specific tweets' contents, which allows us to determine the predictive validity of stock related tweets without the presence of macro-market noise that is unrelated to the specific stock event.

We make contributions to the existing literature in several areas. First, to the best of our knowledge, this study is the first to establish a relationship between stock-specific investor sentiment and stock price movements around earnings announcements. Second, we find that stock-specific investor sentiment is the key determinant of price adjustment in the context of a significant micro-event i.e. an earnings surprise, and that its effect is not moderated by market-wide investor sentiment as proxied by Baker and Wurgler's (2006) sentiment index. Our third contribution is that we provide evidence that the effect of stock-specific investor sentiment is more pronounced for stocks that are hard to value and difficult to arbitrage. This is in line with the findings of Baker and Wurgler (2006) and Mian and Sankaraguruswamy (2012) using a market-wide investor sentiment index.

The remainder of the paper proceeds as follows. Section 2 provides the motivation for studying the impact of stock-specific investor sentiment on the market's evaluation of earnings information. Section 3 describes individual stock-sentiment is channelled

through social media. Section 4 explains our variables and sample. Section 5 tests the effect of investor sentiment on announcement-period abnormal returns. Section 6 examines the cross-sectional variation in the response to investor sentiment. Section 7 checks robustness of results, and Section 8 concludes.

2. Price Formation and Investor Sentiment

There is extensive literature which documents significant stock price movements around earnings announcements (e.g., Brown, Hagerman, Griffin, & Zmijewski, 1987; Bartov, Givoly, & Hayn, 2002; and Kasznik & McNichols, 2002). These studies conclude that firms with positive (negative) earnings outcomes experience significant positive (negative) abnormal stock-price performance and assume that rational investors efficiently impound accounting information into stock prices and arbitrageurs offset demands of irrational investors.

Neal and Wheatley (1998) and Chau, Deesomsak, and Koutmos (2016) provide evidence that that investor sentiment contains unique information for asset pricing which influences equity returns and is a significant determinant of stock price variation. Baker and Wurgler (2006) construct an investment sentiment index and illustrate that time-varying investor sentiment affects the cross-section of stock returns.[4] Other studies find that the changes in the sentiment and limits to arbitrage may impact price formation (Shleifer & Vishny, 1997). Lemmon and Portniaguina (2006) and Kaplanski and Levy (2010) confirm stock mispricing due to investor sentiment. The general consensus in the literature is that investors become overly optimistic (pessimistic) during periods of high (low) investor sentiment, making mistakes in the valuation of future expected cash flows of stocks, leading to overvaluation (undervaluation) that reverses in time. A common feature of the prior studies of investor sentiment, and stock price discovery is that proxies used are measured on an economy-wide or market-wide basis, so their examination sheds light on the effect of market-wide investor sentiment or market mood rather than addressing sentiment about individual stocks. Frequently used proxies include consumer confidence surveys such as the

[4] We use the Baker and Wurgler's (2006) index as a proxy for market sentiment.

University of Michigan Survey Research Center (Bergman & Roychowdhury, 2008 and Seybert & Yang, 2012) or Baker and Wurgler's (2006) composite sentiment index (Mian & Sankaraguruswamy, 2012; Brown, Christensen, Elliott, & Mergenthaler, 2012; and Chau et al., 2016).[5]

The effect of sentiment on price formation is not homogenous across stocks however, it is more pronounced for stocks whose expected cash flows are more uncertain and more difficult to value. Baker and Wurgler (2006, 2007) indicate that stocks which are difficult to value or are difficult to arbitrage - small, young, high volatility, non-dividend-paying, distressed (i.e., low market-to-book), extreme growth (i.e., high market-to-book), and unprofitable stocks - are more likely to be influenced by sentiment while large, mature, stable, high-divided-paying, and medium-growth companies are likely to be influenced less or even negatively by sentiment. In a similar vein, Mian and Sankaraguruswamy (2012) validate the relationship between investor sentiment and the stock market's response to unexpected earnings announcements. They indicate that investors react more to earnings news that is compatible with prevailing investor sentiment and that the effect of investor sentiment is especially pronounced for small stocks, young stocks, high volatility stocks, non-dividend-paying stocks, and stocks with extremely high and low market-to-book ratios. Lemmon and Portniaguina (2006) also find that investor sentiment forecasts the returns of small stocks and stocks with low institutional ownership far more efficiently than large stocks and stocks with high institutional ownership.

In our study, we consider the following questions. Does investor sentiment affect the earnings valuation process due to investors' misinterpretation of incremental cash flows embedded in earnings announcements? Does investor sentiment cause mispricing around earnings announcements to be more pronounced when arbitrageurs fail to eliminate deviations from efficient pricing? Is stock-specific sentiment incorporated into prices in the same manner or on a different basis to market-wide investor sentiment (market mood)? Does market mood adjust stocks

[5] Others include the Conference Board (Lemmon & Portniaguina, 2006 and Chau et al., 2016), the American Association of Individual Investors (AAII) (Brown & Cliff, 2004 and Chau et al., 2016), Investors Intelligence Survey Index (Brown & Cliff, 2004), closed-end fund discounts and net mutual fund redemptions (Neal & Wheatley, 1998), and the Chicago Board Options Exchange Volatility Index (VIX) (Chau et al., 2016).

sensitivity to investors' sentiment about stocks reporting earnings which deviate from analysts' expectations? We also examine the expectation that price sensitivity to investor sentiment is higher for stocks that are subject to uncertainty and limits to arbitrage.

3. Investor Sentiment and Social Media

Major developments have taken place in the interpretation of investor sentiment using textual analysis or computational linguistics in recent years which seeks to move the study away from macro-based sentiment variables and the opinions of professional investors. Many of the studies use internet based opinions but samples are often small, cover a short time period or focus on technology stocks. Antweiler and Frank (2004) focus on 45 Dow Jones Industrial Average companies messages posted on Yahoo! Finance and Raging Bull message boards[6] and find that the effect of sentiment is statistically significant but economically small. Das and Chen (2007) focus on 24 out of the 35 stocks in the Morgan Stanley High-Tech Index (MSH) for two months, July and August 2001, and find that sentiment affects the MSH index but has weaker links to individual stocks.[7] Chen et al. (2014) take a different approach and cover an extensive sample of stocks, more than 7,000, based on reports and comments on Seeking Alpha, a quasi-professional investors forum where reports are edited and similar to institutional investors and investment banks reports, for the period 2005-2012. They find evidence of the impact of sentiment on both stock returns and earnings surprises in the period after a report is published (3 month period) that is statistically significant and economically meaningful. Chen et al. (2014) also make the point that social media have evolved meaningfully in the context of stock reports in recent years. Like Chen et al. (2014) we utilise a broader based sample with a longer time horizon that earlier studies and successfully extract the influence of investor sentiment on individual stocks. Sprenger, Sandner, Tumasjan, & Welpe (2014) analyse stock-related Twitter messages for a 6 month period in 2010 with the focus of the study on

[6] More than 1.5m messages.
[7] The stock effect may be affected by their practice of normalising individual stock returns rather than calculating abnormal returns relative to a stock market index.

classification of events using textual sentiment as a method of event identification.[8] Their methodology based on spikes in message frequency is only partially successful in determining earnings announcements, identifying 224 out of 672 earnings announcements within their sample and study period, but they conclude that in the case of good news there is information leakage before earnings announcements with abnormal returns generated in the run up to announcements but negative news is reflected in the wake of corporate earnings announcements. Thus whilst the studies noted, and others, have suggested that individual stock-sentiment channelled through internet message sites and Twitter have established the relevance of social media for stock price formation our study is the first to provide a comprehensive review of stock sentiment in the case of a corporate earnings announcement, 14,658 earnings announcements, over a meaningful time horizon, 2011-2015.

4. Sample Selection, Variable Definitions, and Summary Statistics

In this section we first describe the sample, then we define the main variables in our study, and finally we report a summary of the sample and variables.

4.1. Sample Selection

To investigate the interaction between stock-specific investor sentiment and the abnormal returns around the time of an earnings announcement, we drew a sample from the NYSE and NASDAQ for the period 2011-2015. We filter stocks based on meeting the following criteria; stocks that release quarterly earnings surprises whose sentiment data, based on Twitter and StockTwits, is available from PsychSignal.

Data is drawn from the following sources. Micro - stock sentiment data - is obtained from PsychSignal and macro - Baker and Wurgler's investment sentiment index - is downloaded from Jeffery Wurgler's website. Earnings data; forecasts, actual earnings and analyst coverage comes from the Institutional Brokers' Estimate System (I/B/E/S). Stock price data including price, bid-ask spreads, and volatility is provided by the

[8] Only 6.9% of the messages they use are related to discussion of earnings results and event categories include Corporate Governance (3%), Financial Issues (13%), Operations (20%), Restructuring (6%), Legal Issues (4%) and the largest category Technical Trading signals (34%) with 23% not classified by their algorithm.

Center for Research in Security Prices (CRSP). Accounting data is from Compustat. Stock style classifications are from Morningstar and institutional ownership records are from Thomson Reuters. After matching stocks across the databases, we arrive at a large sample of 14,658 which meet our selection criteria.[9]

4.2. Variable Definitions

For the construction of our main variable of interest we utilize PsychSignal stock social mood data to measure a stock-level proxy of investor sentiment.[10] Following Antweiler and Frank (2004), we define stock i's investor sentiment index (SI) as the natural logarithm of (1+Bullish Intensity$_{i,t}$) divided by (1+Bearish Intensity$_{i,t}$); where bullish (bearish) intensity represents strength of bullishness (bearishness) present in tweets about stock i on day t. We consider the sum of SIs in a three-day window from 2 days before the earnings announcement until the date of the announcement as the cumulative stock-specific investor sentiment (CSI), that is, $\mathrm{CSI}_{\mathrm{i},(-2,0)} = \sum_{\mathrm{t}=-2}^{0} \mathrm{Ln}\left(\frac{1+\mathrm{Bullish\ Intensity}_{\mathrm{i,t}}}{1+\mathrm{Bearish\ Intensity}_{\mathrm{i,t}}}\right)$.

We employ the investor sentiment index developed by Baker and Wurgler (2006) (B&W), which is available on a monthly basis as a proxy for market-wide investor sentiment in the month of earnings announcements. Baker and Wurgler's investor sentiment index is based on the common variation in six underlying proxies for sentiment determined by principal components analysis: the closed-end fund discount, NYSE share turnover, the number and average first-day returns on IPOs, the equity share in new issues, and the dividend premium. The effect of this investor sentiment index on market movements has been documented by previous research (e.g., Baker & Wurgler, 2006 and Mian & Sankaraguruswamy, 2012).

We use the sensitivity to investor sentiment to test sentiment-driven stock price movements around earnings announcements. We control for CSI and B&W measures into our regression models to capture the effects of investors' sentiment toward firms'

[9] For full descriptions of the data and sources see Appendix A: Variable Definitions and Sources.
[10] See Appendix B for information about PsychSignal data.

specific information and investors' optimism and pessimism about the market in general on stocks prices.

We measure the difference between actual earnings and the average of I/B/E/S analyst forecasts at the release of earnings as a proxy for unexpected earnings (UE) associated with each earnings announcement. We standardize UE by the standard deviation of forecast errors, which is, $\mathrm{SUE}_{i,t} = \frac{\text{Actual EPS} - \text{Forecast EPS}}{\sigma\ (\text{Actual EPS} - \text{Forecast EPS})}$. A positive (negative) earnings surprise consists of an actual earnings announcement that is higher (lower) than expectations.

To examine the effect of uncertainty, we employ four proxies for stocks that may be considered hard/easy to value. Following Baker and Wurgler (2006) and Mian and Sankaraguruswamy (2012) we use volatility, firm size and stock valuation as our first, second, and third proxies of uncertainty. Volatility, as measured by the standard deviation of stock daily abnormal returns, captures the variation in the market's estimation of firm value. We use volatility as a direct measure of stock uncertainty since it is based on the decisions made by market participants. We consider firm size as the second proxy of uncertainty because larger firms tend to have lower valuation uncertainty. Our third proxy, stock valuation, is also likely to be a good measure of uncertainty as growth stocks are generally considered riskier and more difficult to value than value stocks. We employ the Morningstar Style Box classification to assign stocks to small/large cap and growth/value sectors. Morningstar categorises stocks to small, medium, and large cap based on market capitalization. They also use a range of growth and valuation measures to establish the growth-value orientation of stocks and then assigns them to stock style categories; growth, core, and value. Analyst coverage, which is defined as the number of analysts following a stock, is our fourth proxy of uncertainty. Higher analyst coverage indicates lower information uncertainty (Hong, Lim, & Stein, 2000).

To assess the effect of limits to arbitrage, we consider two aspects, potential transaction costs and shareholders sophistication. Following Lam and Wei (2011) we use four proxies for limits to arbitrage; Amihud illiquidity, the number of institutional shareholders, dollar trading volume, and bid-ask spread. Our first proxy Amihud illiquidity, is defined as the absolute value of daily stock return divided by daily dollar trading volume (Amihud, 2002). We consider this illiquidity measure because arbitrage

is risky and costly for stocks with low liquidity (Brunnermeier & Pedersen, 2005). Our second proxy for limits to arbitrage is the number of institutional shareholders which, as a measure of shareholders sophistication, influences the risk of arbitrage (Ali, Hwang, & Trombley, 2003). High institutional ownership has implications for stock lending and arbitrage opportunities. Dollar trading volume is our third proxy, indicating likely price pressure and the time required to trade a large block of shares. Dollar trading volume is measured as the number of shares traded multiplied by the stock price. Our last proxy for limits to arbitrage is the bid-ask spread as arbitrage tends to be particularly risky and costly for stocks that are more costly to trade (Amihud & Mendelson, 1986).

For the construction of our main dependent variable we use a three-day event window relative to the date of the event – the earnings announcement – to estimate the cumulative abnormal returns (CARs). We compute the abnormal return (AR) for each stock on each three days by subtracting the value-weighted market return (R_{mt}) from the stock return (R_{it}) and calculate the $\mathrm{CAR}_{\mathrm{i},(-1,+1)} = \sum_{\mathrm{t}=-1}^{+1}(\mathrm{R}_{\mathrm{i,t}} - \mathrm{R}_{\mathrm{m,t}})$.

4.3. Summary Statistics

Our sample includes 14,658 earnings announcements over the period 2011-2015 for which we can compute our measure of firm specific investor sentiment $\mathrm{CSI}_{\mathrm{i},(-2,0)}$ as well as the cumulative abnormal returns $\mathrm{CAR}_{\mathrm{i},(-1,+1)}$ around the earnings surprise announcement.

Table 1 shows summary statistics for our sample broken by earnings surprise, market cap, stock style, market, sector, and announcement year. It can be inferred that about two-third of 14,658 earnings announcements in our sample represent positive news, whereas about one-third represent negative news. According to Morningstar Style Box classification the number of small stocks in our sample is more than twice that of large stocks, while the number of growth and value stocks are about the same. Breaking the sample based on Global Industry Classification Standard (GICS) indicates that 51% of the stocks in our sample are from information technology, consumer discretionary, and financials sectors, while only 4% of the stocks are from telecommunication services and utilities. Also, looking at the time horizon of the sample illustrates that only 4% of the earnings in our sample were announced in 2011 as the popularity of

Twitter and StockTwits gains critical mass. The highest level of the announcements comes from 2014 which is 32% of the announcements in our sample.

Table 2 reports the descriptive statistics of our key variables for the overall sample. All variables are winsorized at 1% and 99% of their respective distributions to mitigate the impact of outliers. Even though our sample is dominated by positive earnings surprises the mean of $CAR_{(-1,+1)}$, which represents the average response to positive and negative earnings surprises, is -0.03%,. The positive mean of 0.9982 for SUE indicates that the earnings news has on average been positive. The mean of $CSI_{(-2,0)}$ is +0.8678, which indicates that the tweets about the stocks in our sample have on average been bullish. Our measure of market-wide investor sentiment (B&W) has a negative mean close to zero (-0.0130). The reverse sign of $CSI_{(-2,0)}$ and B&W can be considered as the first indication that these two sentiment indexes are different. Comparison of $CSI_{(-2,0)}$ and B&W standard deviations (1.1550 for $CSI_{(-2,0)}$ and 0.0972 for B&W) also illustrates that the $CSI_{(-2,0)}$ values are spread out over a wider range while B&W values are close to the mean.

To obtain a better picture regarding multicollinearity biases that affect our regression estimates we present the correlation matrix in the Appendix C Table C.1.

4.4. Modelling Investor Sentiment

We use regression analysis to determine the relationships between announcement-period abnormal returns, stock-specific investor sentiment, market-wide investor sentiment, and earnings surprises. More specifically, we use cross-sectional regressions to evaluate whether stock-specific investor sentiment is helpful in explaining abnormal returns of stocks announcing earnings surprises. We consider a variety of cross-sectional regression models which range from a parsimonious model using only stock-specific/market-wide investor sentiment to a model that incorporates a list of additional control variables that can affect firms' abnormal returns around the earnings' announcements. Our model with the full list of variables takes the following form:

$$\mathrm{CAR}_{\mathrm{i},(-1,+1)} = \alpha_1 + \beta_1 \mathrm{CSI}_{\mathrm{i},(-2,0)} + \beta_2 \mathrm{SUE} + \beta_3 \mathrm{B\&}W + \beta_4 \mathrm{CSI}_{\mathrm{i},(-2,0)} * \mathrm{B\&}W + \beta_5 \mathrm{Loss} + \beta_6 \mathrm{BM} + \beta_7 \mathrm{Size} + \beta_8 \mathrm{Leverage} + \beta_9 \mathrm{ROA} + \beta_{10} \mathrm{CAR}_{\mathrm{i},(-205,-6)} + \varepsilon \quad (1)$$

The dependent variable is the three-day cumulative abnormal return $\mathrm{CAR}_{\mathrm{i},(-1,+1)}$, which measures the sensitivity of stock prices to stock-specific investor sentiment $\mathrm{CSI}_{\mathrm{i},(-2,0)}$, quarterly earnings surprises (SUE), and market-wide investor sentiment (B&W). As we measure $\mathrm{CAR}_{\mathrm{i},(-1,+1)}$ in the short event window around earnings announcement surprises, we analyse the main price reactions that occur on the arrival of the new earnings information.

Our regression model has several benefits. Inclusion of both measures of investor sentiment and an interaction variable between those indexes $(\mathrm{CSI}_{\mathrm{i},(-2,0)} * \mathrm{B\&}W)$ allows us to carefully examine the individual and joint effect that micro and macro investor sentiment has in the price formation process. By using both measures of investor sentiment in the regression design, we examine whether or not the effect of stock-specific investor sentiment is affected by market-wide investor sentiment. The interaction variable helps us investigate whether the impact of stock-specific investor sentiment is moderated, reinforced, or unaffected by market-wide investor sentiment. As Baker and Wurgler's (2006) investor sentiment index $(\mathrm{B\&}W)$ represents the broad market mood, it might overlap with the stock specific investor mood and affect it. Therefore the effect of stock-specific investor sentiment $\mathrm{CSI}_{\mathrm{i},(-2,0)}$ on investors' reactions to earnings announcements might related to the prevailing investor sentiment in the market $(\mathrm{B\&}W)$. Furthermore, the model includes a set of control variables; loss, book to market ratio, size, leverage, return on assets, and stock price momentum (cumulative abnormal return) prior to earnings announcements. Adding these control variables into our regression model enables us to test the independence of our results from the effects of these well-known variables representing market reaction to earnings information.[11]

[11] We conduct multicollinearity tests in order to ensure that our variables are not highly correlated with each other. The results of the VIF tests show that there is no multicollinearity problem as VIF values are substantially lower than 10.

5. The Effect of Investor Sentiment on Announcement-Period Abnormal Returns

In this section we analyse whether stock-specific investor sentiment plays a significant role in stock price movements around earnings surprises. To this end, we provide a graphical representation of CARs around earnings announcements in Figure 1. We plot the CAR series for three groups of firms; the full sample, the portfolio of firms with positive $CSI_{(-2,0)}$, and the portfolio of firms with negative $CSI_{(-2,0)}$. The CAR series are cumulative from day -10 through day +10, where day 0 is the day on which earnings were announced.

It can be seen that the full sample's CAR fluctuates around zero in the event time interval. For the portfolio of firms with positive $CSI_{(-2,0)}$, CAR abnormally increases around the announcement date and reaches approximately +0.01 on day +1 . After day +1, it roughly remains at the same value. In contrast, the portfolio of firms with negative $CSI_{(-2,0)}$'s CAR gradually decreases from day -5. It has a sharp decline from day -1 until day +1 and then continues to decrease and reaches its minimum in the interval on day +3. Overall, comparing the CARs' trends clearly illustrates the differential effect of positive and negative investor sentiment on the firms' abnormal returns. This confirms that stock-specific investor sentiment plays a critical role in stock pricing around earnings announcements.

The main results of our multivariate analysis are presented in Tables 3 and 4. Panel 1 in Table 3 presents the OLS estimates of regressing the value-weighted $CAR_{(-1,+1)}$ on the two investor sentiment indexes (CSI and B&W). Panel 2 in Table 3 presents the OLS estimates of regressing the equally-weighted $CAR_{(-1,+1)}$ on the two investor sentiment indexes (CSI and B&W). In both Panels 1 and 2 of Table 3, the coefficients on $CSI_{(-2,0)}$ are positive and significant at the 1% level after controlling for year and sector fixed effects. This indicates a strong influence of stock-specific investor sentiment on announcement-period abnormal returns even after controlling for the earnings surprise variable SUE. These results confirm our expectations regarding the impact of CSI on stocks' abnormal returns. The coefficients on SUE are also in line with the expectations, a positive earnings surprise should coincide with increase in announcement abnormal returns and vice versa.

In general, results from Table 3 suggest that there is only weak evidence of market-wide investor sentiment effect (B&W) on announcement-period abnormal returns as the B&W measure is statistically insignificant in 3 out of 4 specifications. This is in contrast to prior studies (e.g. Mian & Sankaraguruswamy, 2012). We find however, that announcement-period abnormal returns are strongly related to stock-specific investor sentiment, supporting and strengthening the results of our correlation analysis. These findings provide support for the notion that stock-level investor sentiment plays a significant role in the stock pricing process around an earnings announcement.

In Table 4 we examine the effect of investor sentiment when we control for additional firm variables. The coefficient on $CSI_{(-2,0)}$[12] is positive and statistically significant in all model specifications at the 1% level. The highly significant coefficients of CSI demonstrate that after controlling for B&W, SUE, Loss, BM, Size, Leverage, ROA, and CAR(-205, -6) the stock-specific sentiment variable CSI contributes significantly to the market's short term assessment of the stocks' value. Additionally, the results show that the variable B&W has a moderate effect on announcement abnormal returns. Although the coefficient on B&W is positive and significant at the 5% level in Model 1, its effect is insignificant after we include the additional control variables.

We also examine the joint effect of the two investor sentiment indexes by including an interaction variable between $CSI_{(-2,0)}$ and B&W in Models 2 and 3. The coefficient on the interaction variable in Model 2 is significant at the 10% level, which indicates a weak joint effect between micro and macro investor sentiment. However, when we control for the additional variables in Model 3 the statistically insignificant coefficient implies that the role of micro investor sentiment in the earnings' valuation is independent from macro investor sentiment.

So far, our regression results confirm a strong relationship between the variable CSI and the abnormal stock returns during the announcements of earnings' surprises. We also find that the effect of CSI is not altered by the inclusion of the B&W in our models,

[12] Since our investor sentiment proxy CSI is measured in the (-2,0) days around the earnings announcements date and our dependent variable CAR is measured in the (-1,+1) days around the earnings announcements date any potential reverse causality concerns, where the level of abnormal returns drives first the level of investors' sentiment and not the opposite are mitigated considerably.

and that the impact of the B&W is less relevant for the investors' valuations of the firm's earnings.

6. Cross-Sectional Variation in the Response to Stock-Specific Investor Sentiment

We continue our analysis by focusing on the mechanisms by which investor sentiment affects stock prices: a) uncertainty in valuation and b) limits to arbitrage. We examine how uncertainty in valuation and the limits to arbitrage enhance or mitigate the effect of investor sentiment on the market's reaction to earnings surprises. To this end, we run our multivariate regression model for sub-samples based on firm characteristics to better gauge the effect of CSI on market participants' valuations of earnings across firms.

To examine the effect of uncertainty, we break our sample down into difficult/easy to value stocks based on four proxies of uncertainty - volatility, firm size, stock valuation, and analyst coverage - and investigate the effect of CSI on earnings' announcements abnormal returns in each sub-group. We form stock groups on the basis of top and bottom quantiles of volatility and analyst coverage distributions. We employ Morningstar Style Box classification to classify stocks as small/large caps and growth/value stocks. We examine whether the effect of investor sentiment is more pronounced for stocks that are subject to uncertainty - stocks with high volatility, growth stocks, small stocks, and stocks with a low number of analyst coverage - which compounds the difficulties of pricing or valuing these stocks.

Similarly, to assess the effect of limits to arbitrage, we partition our sample into high/low limits to arbitrage stocks based on four proxies of limits to arbitrage - Amihud illiquidity, the number of institutional shareholders, dollar trading volume, and bid-ask spread - and investigate the effect of stock-specific investor sentiment on announcement-period abnormal returns in each sub-group. We form stock groups on the basis of top and bottom quantiles (1 & 4) of Amihud illiquidity, number of institutional shareholders, dollar trading volume, and bid-ask spread distributions. We investigate whether there is a stronger effect of investor sentiment on stocks that are difficult to arbitrage - stocks with high Amihud illiquidity, a small number of institutional shareholders, low dollar trading volume, and high bid-ask spread- due to arbitrageurs'

failure to drive stock prices back to their fundamental values. In accordance with the uncertainty and limits to arbitrage hypotheses we expect that the impact of stock-specific investor sentiment is greater for the portfolios of stocks that are difficult to value and difficult to arbitrage.

Table 5 presents the estimates of our multivariate regression model for sub-groups of stocks classified according to our proxies of uncertainty. The effect of our main control variable CSI is greater for the first group of each proxy; this confirms that the effect of micro investor sentiment on the price formation process around earnings announcements is more pronounced for stocks with a higher level of uncertainty. Stocks with high volatility, small stocks, growth stocks, and stocks with low analyst coverage which are subject to greater valuation uncertainties are more sensitive to investor sentiment compared to stocks with low volatility, large stocks, value stocks, and stocks with high analyst coverage. In the bottom end of the table we report the p-values of the Chow tests for the differences between the CSI coefficients across the groups, which confirm that the impact of CSI between the groups is significantly different at a level equal or higher than 5%.

Additionally, the market-wide investor sentiment appears to be unrelated to announcement-period abnormal returns as the coefficients on B&W and $CSI_{(-2,0)}$*B&W are insignificant in the majority of the model specifications. However, this picture changes once we consider the coefficients on B&W for small, large, and growth stocks and $CSI_{(-2,0)}$*B&W for volatile stocks. We note that market-wide investor sentiment has a positive impact on stock prices of small stocks (significant at 10% level) and growth stocks (significant at 1% level), and a negative impact on stock prices of large stocks (significant at 5% level). These results suggest that the general mood about the financial market is important for small, large, and growth stocks. In addition, the general mood about the financial market enhances the effect of stock-specific investor sentiment on announcement-period abnormal returns of volatile stocks (the coefficient on $CSI_{(-2,0)}$*B&W is significant at 5% level), while it does not appear to reinforce or moderate stock-specific investor sentiment effect in other sub-groups at all.

Similarly in Table 6 we address the cross-sectional variation of micro investor sentiment effect on announcement-period abnormal returns for sub-groups of stocks classified according to our proxies for limits to arbitrage. The results show that micro

investor sentiment has a positive on announcement-period abnormal returns of stocks that are difficult to arbitrage. The magnitude of the coefficients on $CSI_{(-2,0)}$ is much greater for stocks with high illiquidity, low number of institutional shareholders, low dollar trading volume, and high bid-ask spread compared to stocks with low illiquidity, high number of institutional shareholders, high dollar trading volume, and low bid-ask spread. The differences in the effect of stock-specific investor sentiment across related sub-groups are also confirmed with the results of the Chow tests at the bottom of the table.

In addition, the coefficients on B&W and $CSI_{(-2,0)}$*B&W are insignificant in almost all sub-groups. The insignificant coefficients on B&W suggest that market-wide investor sentiment does not play a significant role in stock price formation process around earnings announcements while insignificant coefficients on $CSI_{(-2,0)}$*B&W propose that the impact of stock-specific investor sentiment on abnormal returns is unaffected by market-wide investor sentiment. The only exception is the high bid-ask spread stocks sub-group where the coefficient on B&W is significant (at 1% level).

In summary, the results of our multivariate regression analysis in Tables 5 and 6 confirm that the effect of stock-specific investor sentiment is more pronounced for stocks that are hard to value or difficult to arbitrage.

7. Robustness Checks

We conduct additional robustness checks to assess whether our findings remain statistically significant when we employ different measures of earnings surprise and market-wide investor sentiment.[13]

7.1. Earnings Surprises Based on the Seasonal Random Walk Model

In the main analysis, the earnings surprises are measured against the analysts' forecasts while in this section, we examine how stock CARs are affected by investor sentiment when the earnings surprises are measured by the seasonal random walk

[13] We also employ a different measure of stock CARs. We use as a dependent variable the equally weighted stock CARs in all the tables of our study, and our results are qualitatively similar with the main analysis so far (see Tables 4, 5 and 6 in the Appendix C).

model[14], rather than against the analysts' forecasts (see Table 2 in Appendix C). When we replicate the regression analyses in Table 3 and Table 4 with the seasonal-earnings surprises, the results are qualitatively similar with the main analysis.

The results demonstrate that the significant relationship between stock-specific investor sentiment and firm CARs in the presence of earnings' surprises continues to hold when we estimate the earnings surprises with the seasonal random walk model.

7.2. Daily Market-Wide investor Sentiment

In the main analysis, we use Baker and Wurgler's (2006) sentiment index as the proxy for market-wide investor sentiment. This sentiment index is measured on a monthly basis while our proxy for stock-specific investor sentiment is measured on a daily basis. In order to compare better the impact of micro and macro investor sentiment we adopt two alternative proxies for market-wide investor sentiment which are estimated on a daily basis. We use PsychSignal Mood Indexes for NASDAQ100 and S&P500 as the proxies for market mood. We re-examine the impact of stock-specific (micro) investor sentiment on announcement-period abnormal returns while controlling for daily market-wide investor sentiment effect (see Table 3 in Appendix C).

The impact of stock-specific investor sentiment is similar to the results in the main analysis while the impact of market-wide investor sentiment is asymmetric. It seems that public mood about NASDAQ100 influences firms' abnormal returns while public mood about S&P500 is unrelated to the firms' abnormal returns. In addition, the impact of stock-specific (micro) investor sentiment on abnormal returns is unaffected by both macro mood indexes.

8. Conclusion

In this study we ask several important questions about the way investor sentiment affects market reaction to corporate earnings surprises and the impact that sentiment has on price formation around an earnings announcement surprise. We extend the

[14] Seasonal random walk model standardized unexpected earnings (RW_SUE) is the difference between actual earnings and actual earnings lagged four quarters, scaled by stock price at the end of the quarter.

existing work of Baker and Wurgler (2006) and Mian and Sankaraguruswamy (2012) but go beyond the market mood and move from a general consideration of market-wide investor sentiment to a consideration of stock-specific investor sentiment and the role this plays in price formation. Our research is novel in that it simultaneously considers both stock-specific investor sentiment and market-wide investor sentiment in the context of earnings announcements. It forms the basis of a deeper understanding of the mechanisms by which investor sentiment affects stock prices in the presence of a significant event, a corporate earnings announcement surprise. We make contributions to the existing literature in several areas. First, this study is the first to establish a relationship between stock-specific investor sentiment and stock price movements around earnings announcements. Second, we find that stock-specific investor sentiment is the key determinant of price adjustment in the context of a significant micro-event i.e. an earnings surprise. Third that the effect of stock-specific investor sentiment is not moderated by market-wide investor sentiment. Finally, we provide evidence that the effect of stock-specific investor sentiment is more pronounced for stocks that are hard to value and difficult to arbitrage. These findings have powerful economic significance in the world of high frequency algorithmic trading where investors are looking for new inputs into their investment analysis and trading models.

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Main Analysis Tables

Table 1

Summary Statistics: By Earnings Surprise, Market Cap, Stock Style, Market, Sector, and Announcement Year

This table presents summary statistics by earnings surprise, market cap, stock style, market, sector, and announcement year. Positive (negative) standardized unexpected earnings (SUE) consists of actual earnings that are higher (lower) than I/B/E/S analyst forecasts. Market cap and stock style are based on Morningstar Style Box classifications. Stock exchange is the market that stocks are traded on. Sector is classified based on Global Industry Classification Standard (GICS) and announcement year is earnings announcement calendar year. See Appendix A for detailed definitions of the variables. The data set is related to stocks traded on the NYSE and NASDAQ exchanges over the period of 2011-2015.

Total Number of Observations	14,658	Sector	
		Energy	9%
		Materials	6%
Positive & Negative SUE		Industrials	12%
SUE>0	63%	Consumer Discretionary	16%
SUE<0	37%	Consumer Staples	5%
		Health Care	13%
Market Cap		Financials	15%
Large	20%	Information Technology	20%
Small	45%	Telecommunication Services	1%
		Utilities	3%
Stock Style			
Value	25%	Announcement Year	
Growth	30%	2011	4%
		2012	13%
Stock Exchange		2013	21%
NYSE	60%	2014	32%
NASDAQ	40%	2015	30%

Table 2

Descriptive Statistics: Key Variables

This table presents summary statistics; reports the numbers of observations, means, medians, standard deviations, minimums, and maximums of cumulative abnormal return (CAR), cumulative stock-specific investor sentiment (CSI), standardized unexpected earnings (SUE), Baker & Wurgler's (2006) sentiment index (B&W), loss firms (Loss), book-to-market ratio (BM), firms size (Size), leverage (Leverage), return on assets (ROA), as well as the measures of uncertainty proxies including volatility (Volatility) and analyst coverage (Analyst), and the measures of limits to arbitrage proxies including Amihud (2002) illiquidity (Illiquidity), number of institutional shareholders (InstOwner), dollar trading volume ($Volume), and bid-ask spread (Bid-Ask). See Appendix A for detailed definitions of the variables. The data set is related to stocks traded on the NYSE and NASDAQ exchanges over the period of 2011-2015. Stock-specific investor sentiment data comes from PsychSignal and Baker and Wurgler sentiment data is from Wurgler's website. Analyst data is from the Institutional Brokers' Estimate System (I/B/E/S). Stock prices data comes from the Center for Research in Security Prices (CRSP). Accounting data is taken from Compustat. Institutional ownership records come from Thomson Reuters. Variables are winsorized at 1% and 99% of the respective distribution to mitigate the impact of outliers.

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
$CAR_{(-1,+1)}$	14,658	-0.0003	0.0005	0.0801	-0.2581	0.2336
$CSI_{(-2,0)}$	14,658	0.8678	0.8890	1.1550	-1.8335	3.5353
SUE	14,658	0.9982	0.6685	3.6760	-10.7698	16.5128
B&W	14,658	-0.0130	-0.0263	0.0972	-0.2072	0.2909
Loss	14,658	0.2053	0.0000	0.4039	0.0000	1.0000
BM	14,653	0.4830	0.3899	0.4011	-0.3786	1.9921
Size	14,653	7.5694	7.5302	1.7173	3.7731	11.7664
Leverage	14,579	0.2544	0.2301	0.2192	0.0000	0.8784
ROA	14,651	-0.0078	0.0298	0.1814	-0.9204	0.2822
$CAR_{(-205,-6)}$	14,017	-0.0332	-0.0228	0.4787	-1.5889	1.5500
Volatility	14,607	0.0216	0.0183	0.0123	0.0071	0.0685
Analyst	14,633	10.4794	8.0000	7.6101	1.0000	35.0000
Illiquidity (x 10^{-7})	14,608	0.1590	0.0107	0.5530	0.0001	4.1800
InstOwner	12,979	212.26	139.00	220.64	9.00	1261.00
$Volume (M)	14,608	57.5000	15.8000	109.000	0.1108	683.0000
Bid-Ask	14,608	0.0265	0.0140	0.0360	0.0099	0.2449

Figure 1

Cumulative Abnormal Returns to All firms, the Portfolios of Firms with Positive Stock-Specific Investor Sentiment, and the Portfolios of Firms with Negative Stock-Specific Investor Sentiment

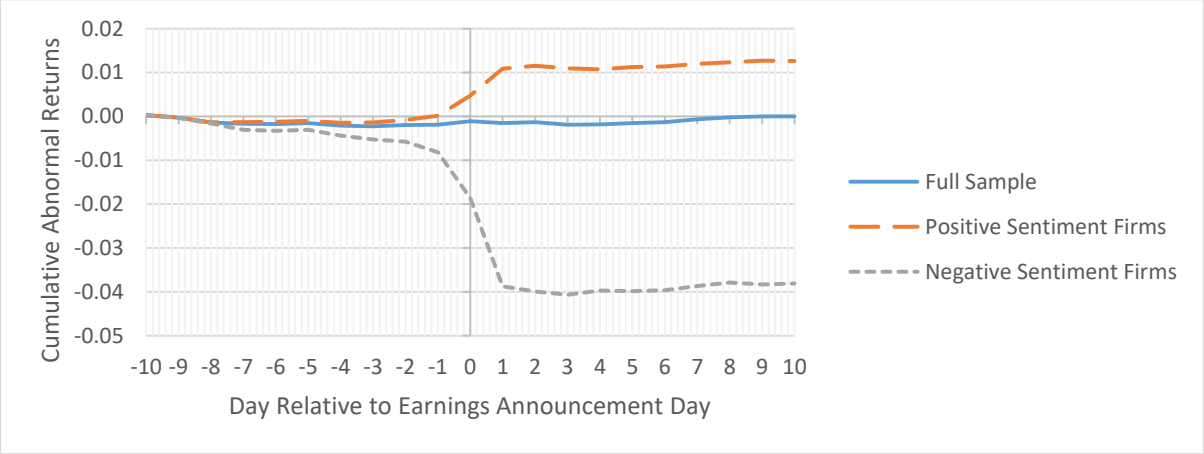

Table 3

Comparison of the Impacts of Stock-Specific and Market-Wide Investor Sentiment on Announcement-Period Abnormal Returns

This table reports the results of regressions for relation of cumulative abnormal return (CAR) with cumulative stock-specific investor sentiment (CSI), Baker & Wurgler's (2006) sentiment index (B&W), and standardized unexpected earnings (SUE). Cumulative abnormal return is measured related to value-weighted market return (panel 1) and equally-weighted market return (panel 2). See Appendix A for detailed definitions of the variables. The data set is related to stocks traded on the NYSE and NASDAQ exchanges over the period of 2011-2015. Stock-specific sentiment data comes from PsychSignal and Baker and Wurgler sentiment data is from Wurgler's website. Analyst data is from the Institutional Brokers' Estimate System (I/B/E/S). Stock prices data comes from the Center for Research in Security Prices (CRSP). Variables are winsorized at 1% and 99% of the respective distribution to mitigate the impact of outliers. All regressions control for year and sector fixed effects whose coefficients are suppressed. The t-statistics reported in parentheses are adjusted for stocks clustering. *, **, and *** indicate significant at the 10, 5, and 1% level, respectively.

Variable	Model 1	Model 2	Variable	Model 3	Model 4
Panel 1: Cumulative Abnormal Return Related to Value-Weighted Market Return					
$CSI_{(-2,0)}$	0.0161***	0.0130***	B&W	0.0146	0.0142*
	(28.23)	(23.81)		(1.65)	(1.69)
SUE		0.0056***	SUE		0.0063***
		(23.95)			(26.08)
Constant	-0.0213***	-0.0195***	Constant	-0.0135***	-0.0137***
	(-5.64)	(-5.38)		(-3.24)	(-3.48)
Year Fixed Effect	Yes	Yes	Year Fixed Effect	Yes	Yes
Sector Fixed Effect	Yes	Yes	Sector Fixed Effect	Yes	Yes
Obs	14658	14658	Obs	14658	14658
Adjusted R^2	0.0558	0.1187	Adjusted R^2	0.0031	0.0853
Variable	Model 5	Model 6	Variable	Model 7	Model 8
Panel 2: Cumulative Abnormal Return Related to Equally-Weighted Market Return					
$CSI_{(-2,0)}$	0.0161***	0.0130***	B&W	-0.0072	-0.0076
	(28.23)	(23.83)		(-0.82)	(-0.90)
SUE		0.0056***	SUE		0.0063***
		(24.04)			(26.17)
Constant	-0.0214***	-0.0195***	Constant	-0.0091**	-0.0092**
	(-5.65)	(-5.38)		(-2.17)	(-2.35)
Year Fixed Effect	Yes	Yes	Year Fixed Effect	Yes	Yes
Sector Fixed Effect	Yes	Yes	Sector Fixed Effect	Yes	Yes
Obs	14658	14658	Obs	14658	14658
Adjusted R^2	0.0556	0.1189	Adjusted R^2	0.0026	0.0853

Table 4

Stock Specific/Market-Wide investor Sentiment and Announcement-Period Responses to Earnings Surprises

This table reports the results of regressions for relation of cumulative abnormal return (CAR) with cumulative stock-specific investor sentiment (CSI). See Appendix A for detailed definitions of the variables. The data set is related to stocks traded on the NYSE and NASDAQ exchanges over the period of 2011-2015. Stock-specific sentiment data comes from PsychSignal and Baker and Wurgler sentiment data is from Wurgler's website. Analyst data is from the Institutional Brokers' Estimate System (I/B/E/S). Stock prices data comes from the Center for Research in Security Prices (CRSP). Accounting data is taken from Compustat. Variables are winsorized at 1% and 99% of the respective distribution to mitigate the impact of outliers. All regressions control for year and sector fixed effects whose coefficients are suppressed. The t-statistics reported in parentheses are adjusted for stocks clustering. *, **, and *** indicate significant at the 10, 5, and 1% level, respectively.

Variable	Model 1	Model 2	Model 3
$CSI_{(-2,0)}$	0.0131***	0.0132***	0.0128***
	(23.84)	(23.77)	(23.04)
SUE	0.0056***	0.0056***	0.0056***
	(23.94)	(23.94)	(22.15)
B&W	0.0167**	0.0083	0.0068
	(2.01)	(0.81)	(0.64)
$CSI_{(-2,0)}$*B&W		0.0098*	0.0066
		(1.70)	(1.12)
Loss			-0.0070***
			(-2.61)
BM			0.0072***
			(3.55)
Size			0.0006
			(1.47)
Leverage			0.0121***
			(3.82)
ROA			-0.0078
			(-1.29)
$CAR_{(-205,-6)}$			-0.0038**
			(-2.08)
Constant	-0.0229***	-0.0224***	-0.0341***
	(-5.80)	(-5.64)	(-5.86)
Year Fixed Effect	Yes	Yes	Yes
Sector Fixed Effect	Yes	Yes	Yes
Obs	14658	14658	13936
Adjusted R^2	0.1189	0.1190	0.1217

Table 5

Variation in the Impact of Stock-Specific Investor Sentiment on Abnormal Returns Relative to Earnings Surprises for Difficult/Easy to Value Firms

This table reports the results of regressions for relation of cumulative abnormal return (CAR) with cumulative stock-specific investor sentiment (CSI) for each subsample split by a given measure of uncertainty proxies. The measures of uncertainty include volatility (Volatility), market cap, stock style, and analyst coverage (Analyst). See Appendix A for detailed definitions of the variables. Top and bottom portfolios (quantiles 1&4) of volatility (Volatility) and analyst coverage (Analyst) are considered for analyse. Market cap and stock style are classified based on Morningstar Style Box. Statistical tests for differences of CSI between two groups are presented. The data set is related to stocks traded on the NYSE and NASDAQ exchanges over the period of 2011-2015. Stock-specific sentiment data comes from PsychSignal and Baker and Wurgler sentiment data is from Wurgler's website. Analyst data is from the Institutional Brokers' Estimate System (I/B/E/S). Stock prices data comes from the Center for Research in Security Prices (CRSP). Accounting data is taken from Compustat. Stock style classifications are from Morningstar. Variables are winsorized at 1% and 99% of the respective distribution to mitigate the impact of outliers. All regressions control for year and sector fixed effects whose coefficients are suppressed. The t-statistics reported in parentheses are adjusted for stocks clustering. *, **, and *** indicate significant at the 10, 5, and 1% level, respectively.

Variable	Volatility		Market Cap		Stock Style		Analyst Coverage	
	High	Low	Small	Large	Growth	Value	Low	High
$CSI_{(-2,0)}$	0.0180***	0.0075***	0.0147***	0.0076***	0.0153***	0.0102***	0.0132***	0.0101***
	(10.99)	(14.27)	(16.35)	(9.91)	(13.95)	(10.86)	(12.08)	(10.35)
SUE	0.0062***	0.0034***	0.0064***	0.0040***	0.0066***	0.0047***	0.0045***	0.0073***
	(10.07)	(12.40)	(17.95)	(9.80)	(13.85)	(11.90)	(12.16)	(14.19)
B&W	0.0121	-0.0082	0.0300*	-0.0310**	0.0715***	-0.0200	0.0122	0.0082
	(0.43)	(-0.69)	(1.71)	(-2.05)	(3.67)	(-1.06)	(0.57)	(0.49)
$CSI_{(-2,0)}$*B&W	0.0370**	0.0063	0.0021	0.0023	-0.0051	0.0040	0.0120	-0.0030
	(2.02)	(1.08)	(0.22)	(0.29)	(-0.42)	(0.43)	(0.98)	(-0.32)
Loss	-0.0179***	0.0070	-0.0105***	0.0092	-0.0058	-0.0087*	-0.0160***	0.0083
	(-3.47)	(1.59)	(-2.86)	(1.50)	(-1.15)	(-1.76)	(-4.15)	(1.39)
BM	0.0096**	0.0033	0.0048	0.0058*	0.0007	0.0062*	0.0064	0.0059*
	(2.16)	(1.28)	(1.49)	(1.86)	(0.13)	(1.73)	(1.64)	(1.70)
Size	0.0019	0.0001	-0.0008	0.0014	0.0017*	-0.0004	-0.0007	0.0019*
	(1.15)	(0.29)	(-0.67)	(1.40)	(1.93)	(-0.54)	(-0.75)	(1.89)
Leverage	0.0233**	0.0015	0.0139***	0.0004	0.0085	0.0099*	0.0132**	0.0146**
	(2.42)	(0.39)	(2.67)	(0.08)	(1.48)	(1.67)	(2.01)	(2.19)
ROA	-0.0195**	-0.0034	-0.0089	-0.0016	-0.0144	0.0036	-0.0115	-0.0198
	(-2.22)	(-0.18)	(-1.11)	(-0.08)	(-1.33)	(0.23)	(-1.39)	(-1.18)
$CAR_{(-205,-6)}$	-0.0038	-0.0090**	-0.0080***	-0.0077	-0.0000	-0.0133***	-0.0043	-0.0005
	(-1.50)	(-2.14)	(-3.10)	(-1.41)	(-0.00)	(-3.54)	(-1.51)	(-0.11)
Constant	-0.0614***	-0.0085	-0.0307**	-0.0215*	-0.0696***	-0.0099	-0.0300**	-0.0388***
	(-3.45)	(-1.11)	(-2.56)	(-1.82)	(-5.99)	(-0.93)	(-2.22)	(-3.28)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	3274	3610	6489	2930	4360	3681	4296	3556
Adjusted R^2	0.1089	0.1435	0.1455	0.0974	0.1319	0.1150	0.1185	0.1198
Chow Test	37.95		35.97		12.68		4.52	
p-value	(0.000)		(0.000)		(0.000)		(0.034)	

Table 6

Variation in the Impact of Stock-Specific Investor Sentiment on Abnormal Returns Relative to Earnings Surprises for High/Low Limits to Arbitrage Firms

This table reports the results of regressions for relation of cumulative abnormal return (CAR) with cumulative stock-specific investor sentiment (CSI) for each subsample split by a given measure of limits to arbitrage proxies. The measures of limits to arbitrage include Amihud (2002) illiquidity (Illiquidity), number of institutional shareholders (InstOwner), dollar trading volume ($Volume), and bid-ask spread (Bid-Ask). See Appendix A for detailed definitions of the variables. Top and bottom portfolios (quantiles 1&4) of Amihud (2002) illiquidity (Illiquidity), number of institutional shareholders (InstOwner), dollar trading volume ($Volume), and bid-ask spread (Bid-Ask) are considered for analyse. Statistical tests for differences of CSI between two groups are presented. The data set is related to stocks traded on the NYSE and NASDAQ exchanges over the period of 2011-2015. Stock-specific sentiment data comes from PsychSignal and Baker and Wurgler sentiment data is from Wurgler's website. Analyst data is from the Institutional Brokers' Estimate System (I/B/E/S). Stock prices data comes from the Center for Research in Security Prices (CRSP). Accounting data is taken from Compustat. Institutional ownership records come from Thomson Reuters. Variables are winsorized at 1% and 99% of the respective distribution to mitigate the impact of outliers. All regressions control for year and sector fixed effects whose coefficients are suppressed. The t-statistics reported in parentheses are adjusted for stocks clustering. *, **, and *** indicate significant at the 10, 5, and 1% level, respectively.

Variable	Amihud Illiquidity		No of Institutional Shareholders		Dollar Trading Volume		Bid-Ask Spread	
	High	Low	Low	High	Low	High	High	Low
$CSI_{(-2,0)}$	0.0156***	0.0083***	0.0147***	0.0074***	0.0144***	0.0099***	0.0123***	0.0097***
	(11.17)	(10.59)	(9.84)	(9.10)	(11.09)	(11.09)	(9.88)	(9.63)
SUE	0.0054***	0.0045***	0.0047***	0.0053***	0.0055***	0.0055***	0.0052***	0.0054***
	(10.63)	(11.49)	(8.61)	(13.14)	(11.89)	(12.73)	(10.06)	(11.46)
B&W	0.0228	0.0173	0.0274	-0.0182	0.0245	0.0131	0.0795***	-0.0145
	(0.85)	(1.07)	(1.02)	(-1.12)	(0.96)	(0.79)	(3.30)	(-0.84)
$CSI_{(-2,0)}$*B&W	0.0066	-0.0022	0.0181	0.0071	0.0026	0.0013	0.0037	0.0024
	(0.41)	(-0.27)	(1.09)	(0.85)	(0.18)	(0.14)	(0.25)	(0.23)
Loss	-0.0219***	0.0059	-0.0195***	0.0113**	-0.0175***	0.0050	-0.0185***	-0.0059
	(-4.72)	(1.21)	(-3.65)	(2.03)	(-3.89)	(0.91)	(-3.34)	(-1.25)
BM	0.0060	0.0055	0.0044	0.0027	0.0037	0.0085**	0.0095*	0.0087***
	(1.36)	(1.64)	(0.89)	(0.80)	(0.83)	(2.35)	(1.65)	(2.66)
Size	-0.0006	0.0020**	-0.0010	0.0011	-0.0013	0.0029***	0.0001	0.0010
	(-0.37)	(2.08)	(-0.68)	(1.13)	(-0.84)	(2.59)	(0.10)	(1.23)
Leverage	0.0140*	0.0119**	0.0173**	0.0126**	0.0148*	0.0218***	0.0131*	0.0106**
	(1.66)	(2.24)	(2.12)	(2.30)	(1.94)	(3.30)	(1.71)	(1.97)
ROA	-0.0168*	-0.0163	-0.0124	-0.0142	-0.0116	0.0152	-0.0101	-0.0220
	(-1.91)	(-0.84)	(-1.26)	(-0.70)	(-1.23)	(0.70)	(-0.74)	(-1.43)
$CAR_{(-205,-6)}$	-0.0022	-0.0009	-0.0018	-0.0024	-0.0024	-0.0023	0.0048	-0.0156***
	(-0.80)	(-0.19)	(-0.65)	(-0.49)	(-0.78)	(-0.55)	(1.48)	(-4.14)
Constant	-0.0260	-0.0349***	-0.0314	-0.0232*	-0.0242	-0.0550***	-0.0504***	-0.0282**
	(-1.47)	(-3.00)	(-1.58)	(-1.95)	(-1.44)	(-4.17)	(-3.63)	(-2.34)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	3285	3609	2893	3201	3375	3582	3123	3640
Adjusted R^2	0.1310	0.0896	0.1062	0.1107	0.1321	0.1003	0.1152	0.1090
Chow Test	21.01		18.29		8.30		2.71	
p-value	(0.000)		(0.000)		(0.004)		(0.099)	

Appendix A: Variable Definitions and Sources

Variable	Definitions	Source
$CAR_{(-1,+1)}$	Cumulative Abnormal Return related to value-weighted market return over the three-day window centred on the earnings announcement date.	CRSP
$CSI_{(-2,0)}$	Cumulative stock-specific investor sentiment Index over the three-day window from 2 days before the earnings announcement date until the date of announcement, where Sentiment Index (SI) is measured as natural logarithm of (1+Bulish Intensity)/(1+Bearish Intensity).	PsychSignal
SUE	Standardized Unexpected Earnings is measured as the difference between I/B/E/S actual earnings and the average of estimates at the release of earnings, divided by the standard deviation of forecast errors.	I/B/E/S
B&W	Baker & Wurgler's (2006) Index of investor sentiment (market-wide) in the month of earnings announcement. Baker and Wurgler's Index is available up to the end of September, 2015 from Jeffrey Wurgler's website. Holt–Winters nonseasonal smoothing method is used to forecast the index for October, November, and December, 2015 (based on index values over the period of January, 2011 to September, 2015).	http://people.stern.nyu.edu/jwurgler/
CSI*B&W	An interaction variable of investor sentiment indexes, between cumulative stock-specific investor sentiment Index, $CSI_{(-2,0)}$, and Market-Wide Investor Sentiment, B&W.	PsychSignal & http://people.stern.nyu.edu/jwurgler/
Loss	An indicator variable equal to 1 for firms reporting negative earnings in fiscal quarter.	I/B/E/S
BM	The Book value of equity divided by Market value of equity at the end of previous calendar year.	Compustat
Size	The natural logarithm of share price times shares outstanding at the end of previous calendar year.	Compustat
Leverage	The sum of long term debt and the debt in current liabilities divided by total assets at the end of previous calendar year.	Compustat
ROA	The ratio of net income to total assets at the end of previous calendar year.	Compustat
$CAR_{(-205,-6)}$	Cumulative Abnormal Return related to value-weighted market return over the (-205,-6) day interval prior earnings announcements.	CRSP
Volatility	Standard deviation of stock daily abnormal return related to value-weighted market return over the (-205,-6) day interval prior earnings announcements.	CRSP
Analyst	The number of analysts providing one year ahead EPS forecast in the month prior earnings announcements.	I/B/E/S
ILLIQUIDITY	Amihud (2002) illiquidity measured as the average of absolute daily return divided by daily dollar trading volume over the (-205,-6) day interval prior earnings announcements.	CRSP
INSTOWNER	The number of institutional shareholders holding a firm's shares at the end of previous calendar year.	Thomson Reuters
$Volume	Dollar trading volume measured as the average of daily share trading volume times closing price over the (-205,-6) day interval prior earnings announcements.	CRSP
Bid-Ask	Average daily bid-ask spread over the (-205,-6) day interval prior earnings announcements.	CRSP
Small/Large stocks	Market cap classification based on Morningstar style box in the month prior earnings announcements.	Morningstar
Growth/value stocks	Stock style classification based on Morningstar style box in the month prior earnings announcements.	Morningstar

Appendix B: PsychSignal

Stock-specific investor sentiment and daily mood indexes are from PsychSignal. PsychSignal is a leading provider of real-time trader mood data, which is built on top of Twitter and StockTwits messages.

PsychSignal creates a highly specialized natural language processing (NLP) engine, which analyses millions of tweets every day in order to quantify the public's mood about certain stocks and other securities. The NLP uses a sophisticated linguistic based approach to sentiment mining that is able to correctly extract, interpret, and score online conversations in the context of stock prices. This is important as word lists that are not developed for finance might not correctly reflect tone in financial text (Loughran & McDonald, 2011). The NLP processes the language surrounding stocks and securities' names the way a professional trader would. It detects online community's mood bullishness and bearishness and also scores the mood intensity.

PsychSignal rolls up 24 hours of data based on NYC EST time and releases mood data in a daily fashion at approximately 12:01 AM. Its technology works as follows: ingests social media firehoses, categorizes conversations by security, analyses mood, aggregates mood scores for each security based upon the total volume and mood intensity, and outputs signal. In fact, PsychSignal publishes today's trading signal before the open. The outputs clarify how the public mood surrounding stocks and securities is trending so that PsychSignal users are able to predict market moves in advance. Therefore they can execute reliable algorithmic trading strategies which consider a real-time view into the public's psychology about markets.

We use PsychSignal Mood Indexes and stock mood data in this study. PsychSignal Mood Indexes are real-time volatility indexes which measure traders changing mood in the NASDAQ100 and S&P500. The stock mood data is numerical raw data containing symbol, timestamp (UTC), bullish-intensity, bearish-intensity, bull-minus-bear, bull-scored-messages, bear-scored-messages, bull-bear-msg-ratio, and total-scanned-messages. The volume measures and sentiment analytics are defines as;

bull-scored-messages: total count of bullish sentiment messages scored by PsychSignal's algorithm.

bear-scored-messages: total count of bearish sentiment messages scored by PsychSignal's algorithm.

bullish-intensity: score for each message's language for the strength of the bullishness present in the messages on a 0-4 scale. 0 indicates no bullish sentiment measured, 4 indicates strongest bullish sentiment measured. 4 is rare.

bearish-intensity: score for each message's language for the strength of the bearishness present in the messages on a 0-4 scale. 0 indicates no bearish sentiment measured, 4 indicates strongest bearish sentiment measured. 4 is rare.

total-scanned-messages: number of messages coming through PsychSignal's feeds and attributable to a symbol regardless of whether the PsychSignal sentiment engine can score them for bullish or bearish intensity.

The total message count includes natural messages, which do not contain bullish or bearish emotion.

Appendix C: Additional Empirical Results

Table C.1

Correlation Matrix

This table presents correlations of variables, cumulative abnormal return (CAR), cumulative stock-specific investor sentiment (CSI), standardized unexpected earnings (SUE), Baker & Wurgler's (2006) sentiment index (B&W), loss firms (Loss), book to market ratio (BM), firms size (Size), leverage (Leverage), return on assets (ROA), as well as the measures of uncertainty proxies including volatility (Volatility) and analyst coverage (Analyst), and measures of limits to arbitrage proxies including Amihud (2002) illiquidity (Illiquidity), number of institutional owners (InstOwner), dollar trading volume ($Volume), and bid-ask spread (Bid-Ask). See Appendix A for detailed definitions of the variables. The data set is related to stocks traded on the NYSE and NASDAQ exchanges over the period of 2011-2015. Stock-specific sentiment data comes from PsychSignal and Baker and Wurgler sentiment data is from Wurgler's website. Analyst data is from the Institutional Brokers' Estimate System (I/B/E/S). Stock prices data comes from the Center for Research in Security Prices (CRSP). Accounting data is taken from Compustat. Institutional ownership records come from Thomson Reuters. Variables are winsorized at 1% and 99% of the respective distribution to mitigate the impact of outliers.

Variable	$CAR_{(-1,+1)}$	$CSI_{(-2,0)}$	SUE	B&W	Loss	BM	Size	Leverage	ROA	$CAR_{(-205,-6)}$	Volatility	Analyst	Illiquidity	InstOwner	$Volume	Bid-Ask
$CAR_{(-1,+1)}$	1.0000															
$CSI_{(-2,0)}$	0.2243	1.0000														
SUE	0.2891	0.1570	1.0000													
B&W	0.0082	-0.0360	0.0026	1.0000												
Loss	-0.1037	-0.0654	-0.2236	0.0021	1.0000											
BM	0.0086	0.0165	-0.0557	0.0245	-0.0236	1.0000										
Size	0.0268	-0.0388	0.0715	-0.0163	-0.4147	-0.1599	1.0000									
Leverage	0.0124	0.0387	-0.0944	-0.0084	-0.1086	-0.0287	0.1340	1.0000								
ROA	0.0411	0.0128	0.0761	-0.0047	-0.6066	0.0488	0.4386	0.0834	1.0000							
$CAR_{(-205,-6)}$	0.0001	0.0676	0.0247	-0.0369	-0.0208	0.0519	-0.0303	0.0100	-0.0634	1.0000						
Volatility	-0.0439	-0.0980	-0.0341	0.0260	0.5212	-0.0533	-0.5821	-0.2290	-0.5405	-0.0165	1.0000					
Analyst	0.0244	-0.1103	0.0738	-0.0099	-0.2553	-0.1383	0.6752	0.0025	0.2489	-0.0087	-0.2841	1.0000				
Illiquidity	-0.0114	0.0074	-0.0334	0.0142	0.2357	0.0597	-0.3629	-0.0833	-0.2902	0.0798	0.2902	-0.2200	1.0000			
InstOwner	0.0141	-0.0893	0.0501	-0.0362	-0.2751	-0.0728	0.7911	0.0736	0.2705	0.0052	-0.4350	0.6544	-0.2278	1.0000		
$Volume	0.0068	-0.1405	0.0383	-0.0147	-0.1742	-0.0744	0.6750	0.0260	0.1764	-0.0111	-0.2300	0.6491	-0.1468	0.8531	1.0000	
Bid-Ask	-0.0177	0.0144	-0.0392	-0.0181	0.1181	-0.1045	-0.2066	-0.1121	-0.0948	-0.0041	0.1760	-0.1923	0.4431	-0.2361	-0.1130	1.0000

Table C.2

Stock-Specific/Market-Wide Investor Sentiment and Market Reactions to Seasonal Random Walk Model Earnings Surprises; the Alternative Measure of Earnings Surprises

This table reports the results of regressions for relation of cumulative abnormal return (CAR) with cumulative stock-specific investor sentiment (CSI). Earnings surprise is measured by seasonal random walk model. Seasonal random walk model standardized unexpected earnings (RW_SUE) is the difference between actual earnings and actual earnings lagged four quarters, scaled by stock price at the end of the quarter. See Appendix A for detailed definitions of other variables. The data set is related to stocks traded on the NYSE and NASDAQ exchanges over the period of 2011-2015. Stock-specific sentiment data comes from PsychSignal and Baker and Wurgler sentiment data is from Wurgler's website. Analyst data is from the Institutional Brokers' Estimate System (I/B/E/S). Stock prices data comes from the Center for Research in Security Prices (CRSP). Accounting data is taken from Compustat. Variables are winsorized at 1% and 99% of the respective distribution to mitigate the impact of outliers. All regressions control for year and sector fixed effects whose coefficients are suppressed. The t-statistics reported in parentheses are adjusted for stocks clustering. *, **, and *** indicate significant at the 10, 5, and 1% level, respectively.

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
$CSI_{(-2,0)}$	0.0150***		0.0150***	0.0152***	0.0151***
	(23.36)		(23.37)	(23.21)	(23.05)
RW_SUE	0.3627***	0.4319***	0.3616***	0.3610***	0.3301***
	(8.03)	(8.99)	(8.00)	(7.99)	(7.09)
B&W		0.0171*	0.0199**	0.0135	0.0108
		(1.72)	(2.04)	(1.09)	(0.86)
$CSI_{(-2,0)}$*B&W				0.0071	0.0061
				(1.09)	(0.94)
Loss					-0.0161***
					(-4.97)
BM					0.0084***
					(3.40)
Size					0.0011**
					(2.05)
Leverage					0.0045
					(1.17)
ROA					-0.0141*
					(-1.89)
$CAR_{(-205,-6)}$					-0.0074***
					(-3.13)
Constant	-0.0166***	-0.0104**	-0.0206***	-0.0203***	-0.0337***
	(-3.91)	(-2.22)	(-4.42)	(-4.29)	(-4.76)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
Sector Fixed Effect	Yes	Yes	Yes	Yes	Yes
Obs	10137	10137	10137	10137	10064
Adjusted R^2	0.0597	0.0129	0.0600	0.0600	0.0668

Table C.3

Daily Stock-Specific/Market-Wide investor Sentiment and Announcement-Period Responses to Earnings Surprises

This table reports the results of regressions for relation of cumulative abnormal return (CAR) with cumulative stock-specific investor sentiment (CSI) while the effect of daily market-wide investor sentiment is controlled. NASDAQ100 and S&P500 Mood Indexes are considered as proxies for market-wide investor sentiment. See Appendix A for detailed definitions of the variables. The data set is related to stocks traded on the NYSE and NASDAQ exchanges over the period of 2011-2015. Stock-specific sentiment data comes from PsychSignal and Baker and Wurgler sentiment data is from Wurgler's website. Analyst data is from the Institutional Brokers' Estimate System (I/B/E/S). Stock prices data comes from the Center for Research in Security Prices (CRSP). Accounting data is taken from Compustat. Variables are winsorized at 1% and 99% of the respective distribution to mitigate the impact of outliers. All regressions control for year and sector fixed effects whose coefficients are suppressed. The t-statistics reported in parentheses are adjusted for stocks clustering. *, **, and *** indicate significant at the 10, 5, and 1% level, respectively.

Variable	Model 1	Model 2	Model 3
$CSI_{(-2,0)}$	0.0130***	0.0130***	0.0127***
	(23.77)	(21.89)	(21.62)
SUE	0.0056***	0.0056***	0.0056***
	(23.92)	(23.92)	(22.15)
$CSI_{ndx(-2,0)}$	0.0018***	0.0018***	0.0016***
	(4.13)	(3.12)	(2.74)
$CSI_{spx(-2,0)}$	0.0002	0.0001	0.0001
	(0.35)	(0.14)	(0.22)
$CSI_{(-2,0)}$*$CSI_{ndx(-2,0)}$		-0.0000	-0.0000
		(-0.03)	(-0.08)
$CSI_{(-2,0)}$*$CSI_{spx(-2,0)}$		0.0001	-0.0000
		(0.20)	(-0.08)
Loss			-0.0068**
			(-2.51)
BM			0.0073***
			(3.58)
Size			0.0005
			(1.18)
Leverage			0.0123***
			(3.87)
ROA			-0.0076
			(-1.26)
$CAR_{(-205,-6)}$			-0.0039**
			(-2.16)
Constant	-0.0207***	-0.0207***	-0.0321***
	(-5.71)	(-5.71)	(-5.66)
Year Fixed Effect	Yes	Yes	Yes
Sector Fixed Effect	Yes	Yes	Yes
Obs	14658	14658	13936
Adjusted R^2	0.1199	0.1198	0.1224

Table C.4

The Impacts of Stock-Specific/Market-Wide Investor Sentiment and Earnings Surprises on Announcement-Period Equally-Weighted Abnormal Returns

This table reports the results of regressions for relation of cumulative abnormal return (CAR) with cumulative stock-specific investor sentiment (CSI). Cumulative abnormal return (CAR) is related to equally-weighted market return. See Appendix A for detailed definitions of other variables. The data set is related to stocks traded on the NYSE and NASDAQ exchanges over the period of 2011-2015. Stock-specific sentiment data comes from PsychSignal and Baker and Wurgler sentiment data is from Wurgler's website. Analyst data is from the Institutional Brokers' Estimate System (I/B/E/S). Stock prices data comes from the Center for Research in Security Prices (CRSP). Accounting data is taken from Compustat. Variables are winsorized at 1% and 99% of the respective distribution to mitigate the impact of outliers. All regressions control for year and sector fixed effects whose coefficients are suppressed. The t-statistics reported in parentheses are adjusted for stocks clustering. *, **, and *** indicate significant at the 10, 5, and 1% level, respectively.

Variable	Model 1	Model 2	Model 3
$CSI_{(-2,0)}$	0.0130***	0.0131***	0.0128***
	(23.80)	(23.71)	(22.96)
SUE	0.0056***	0.0056***	0.0056***
	(24.04)	(24.04)	(22.26)
B&W	-0.0051	-0.0131	-0.0137
	(-0.62)	(-1.28)	(-1.31)
$CSI_{(-2,0)}$*B&W		0.0092	0.0064
		(1.61)	(1.08)
Loss			-0.0065**
			(-2.42)
BM			0.0072***
			(3.53)
Size			0.0006
			(1.36)
Leverage			0.0118***
			(3.73)
ROA			-0.0085
			(-1.41)
$CAR_{(-205,-6)}$			-0.0042**
			(-2.29)
Constant	-0.0184***	-0.0180***	-0.0291***
	(-4.66)	(-4.52)	(-4.97)
Year Fixed Effect	Yes	Yes	Yes
Sector Fixed Effect	Yes	Yes	Yes
Obs	14658	14658	13936
Adjusted R^2	0.1189	0.1190	0.1215

Table C.5

Variation in the Impact of Stock-Specific Investor Sentiment on Equally-Weighted Abnormal Returns Relative to Earnings Surprises for Difficult/Easy to Value Firms

This table reports the results of regressions for relation of cumulative abnormal return (CAR) with cumulative stock-specific investor sentiment (CSI) for each subsample split by a given measure of uncertainty proxies. Cumulative abnormal return (CAR) is related to equally-weighted market return. The measures of uncertainty include volatility (Volatility), market cap, stock style, and analyst coverage (Analyst). See Appendix A for detailed definitions of the variables. Top and bottom portfolios (quantiles 1&4) of volatility (Volatility) and analyst coverage (Analyst) are considered for analyse. Market cap and stock style are classified based on Morningstar Style Box. Statistical tests for differences of CSI between two groups are presented. The data set is related to stocks traded on the NYSE and NASDAQ exchanges over the period of 2011-2015. Stock-specific sentiment data comes from PsychSignal and Baker and Wurgler sentiment data is from Wurgler's website. Analyst data is from the Institutional Brokers' Estimate System (I/B/E/S). Stock prices data comes from the Center for Research in Security Prices (CRSP). Accounting data is taken from Compustat. Stock style classifications are from Morningstar. Variables are winsorized at 1% and 99% of the respective distribution to mitigate the impact of outliers. All regressions control for year and sector fixed effects whose coefficients are suppressed. The t-statistics reported in parentheses are adjusted for stocks clustering. *, **, and *** indicate significant at the 10, 5, and 1% level, respectively.

Variable	Volatility		Market Cap		Stock Style		Analyst Coverage	
	High	Low	Small	Large	Growth	Value	Low	High
$CSI_{(-2,0)}$	0.0181***	0.0076***	0.0147***	0.0078***	0.0152***	0.0103***	0.0131***	0.0101***
	(11.04)	(14.30)	(16.32)	(10.00)	(13.78)	(10.84)	(12.09)	(10.39)
SUE	0.0062***	0.0034***	0.0064***	0.0040***	0.0066***	0.0047***	0.0045***	0.0073***
	(10.23)	(12.25)	(18.05)	(9.77)	(13.90)	(11.90)	(12.22)	(14.33)
B&W	-0.0143	-0.0218*	0.0082	-0.0427***	0.0476**	-0.0331*	-0.0080	-0.0114
	(-0.52)	(-1.82)	(0.47)	(-2.78)	(2.46)	(-1.75)	(-0.38)	(-0.68)
$CSI_{(-2,0)}$*B&W	0.0375**	0.0054	0.0023	0.0018	-0.0056	0.0033	0.0118	-0.0037
	(2.06)	(0.91)	(0.24)	(0.22)	(-0.47)	(0.35)	(0.98)	(-0.39)
Loss	-0.0172***	0.0069	-0.0098***	0.0088	-0.0049	-0.0084*	-0.0155***	0.0090
	(-3.36)	(1.54)	(-2.71)	(1.40)	(-0.99)	(-1.71)	(-4.04)	(1.55)
BM	0.0094**	0.0032	0.0049	0.0057*	0.0008	0.0064*	0.0065*	0.0053
	(2.15)	(1.22)	(1.54)	(1.85)	(0.15)	(1.83)	(1.65)	(1.54)
Size	0.0021	0.0001	-0.0008	0.0014	0.0016*	-0.0005	-0.0007	0.0021**
	(1.32)	(0.27)	(-0.68)	(1.36)	(1.83)	(-0.71)	(-0.76)	(1.99)
Leverage	0.0218**	0.0017	0.0137***	0.0001	0.0085	0.0096	0.0129*	0.0133**
	(2.26)	(0.44)	(2.65)	(0.01)	(1.48)	(1.61)	(1.94)	(2.04)
ROA	-0.0206**	-0.0060	-0.0098	-0.0067	-0.0142	0.0012	-0.0123	-0.0221
	(-2.34)	(-0.33)	(-1.23)	(-0.33)	(-1.33)	(0.08)	(-1.49)	(-1.32)
$CAR_{(-205,-6)}$	-0.0039	-0.0107***	-0.0080***	-0.0099*	0.0002	-0.0143***	-0.0040	-0.0015
	(-1.51)	(-2.71)	(-3.12)	(-1.86)	(0.06)	(-3.76)	(-1.41)	(-0.36)
Constant	-0.0559***	-0.0051	-0.0251**	-0.0186	-0.0624***	-0.0059	-0.0261*	-0.0347***
	(-3.14)	(-0.65)	(-2.08)	(-1.54)	(-5.34)	(-0.55)	(-1.93)	(-2.90)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	3274	3610	6489	2930	4360	3681	4296	3556
Adjusted R^2	0.1084	0.1452	0.1445	0.1004	0.1294	0.1167	0.1176	0.1196
Chow Test	37.79		34.07		11.55		4.32	
p-value	(0.000)		(0.000)		(0.001)		(0.038)	

Table C.6

Variation in the Impact of Stock-Specific Investor Sentiment on Equally-Weighted Abnormal Returns Relative to Earnings Surprises for high/Low Limits to Arbitrage Firms

This table reports the results of regressions for relation of cumulative abnormal return (CAR) with cumulative stock-specific investor sentiment (CSI) for each subsample split by a given measure of limits to arbitrage proxies. Cumulative abnormal return (CAR) is related to equally-weighted market return. The measures of limits to arbitrage include Amihud (2002) illiquidity (Illiquidity), number of institutional shareholders (InstOwner), dollar trading volume ($Volume), and bid-ask spread (Bid-Ask). See Appendix A for detailed definitions of the variables. Top and bottom portfolios (quantiles 1&4) of Amihud (2002) illiquidity (Illiquidity), number of institutional shareholders (InstOwner), dollar trading volume ($Volume), and bid-ask spread (Bid-Ask) are considered for analyse. Statistical tests for differences of CSI between two groups are presented. The data set is related to stocks traded on the NYSE and NASDAQ exchanges over the period of 2011-2015. Stock-specific sentiment data comes from PsychSignal and Baker and Wurgler sentiment data is from Wurgler's website. Analyst data is from the Institutional Brokers' Estimate System (I/B/E/S). Stock prices data comes from the Center for Research in Security Prices (CRSP). Accounting data is taken from Compustat. Institutional ownership records come from Thomson Reuters. Variables are winsorized at 1% and 99% of the respective distribution to mitigate the impact of outliers. All regressions control for year and sector fixed effects whose coefficients are suppressed. The t-statistics reported in parentheses are adjusted for stocks clustering. *, **, and *** indicate significant at the 10, 5, and 1% level, respectively.

Variable	Amihud Illiquidity		No of Institutional Shareholders		Dollar Trading Volume		Bid-Ask Spread	
	High	Low	Low	High	Low	High	High	Low
$CSI_{(-2,0)}$	0.0155***	0.0084***	0.0146***	0.0076***	0.0143***	0.0099***	0.0122***	0.0097***
	(11.18)	(10.71)	(9.76)	(9.26)	(11.01)	(11.18)	(9.86)	(9.65)
SUE	0.0055***	0.0045***	0.0047***	0.0053***	0.0056***	0.0055***	0.0052***	0.0054***
	(10.73)	(11.49)	(8.67)	(13.10)	(12.01)	(12.77)	(10.21)	(11.43)
B&W	0.0033	-0.0020	0.0046	-0.0346**	0.0065	-0.0064	0.0547**	-0.0291*
	(0.12)	(-0.13)	(0.17)	(-2.09)	(0.26)	(-0.39)	(2.29)	(-1.70)
$CSI_{(-2,0)}$*B&W	0.0066	-0.0024	0.0187	0.0059	0.0021	0.0005	0.0050	0.0028
	(0.42)	(-0.29)	(1.13)	(0.71)	(0.15)	(0.06)	(0.35)	(0.26)
Loss	-0.0216***	0.0072	-0.0189***	0.0118**	-0.0171***	0.0059	-0.0178***	-0.0050
	(-4.63)	(1.50)	(-3.52)	(2.17)	(-3.80)	(1.08)	(-3.25)	(-1.06)
BM	0.0058	0.0049	0.0044	0.0025	0.0036	0.0082**	0.0091	0.0081**
	(1.32)	(1.47)	(0.90)	(0.72)	(0.81)	(2.32)	(1.57)	(2.52)
Size	-0.0007	0.0020**	-0.0010	0.0011	-0.0014	0.0028**	0.0002	0.0009
	(-0.40)	(2.11)	(-0.66)	(1.14)	(-0.87)	(2.49)	(0.17)	(1.14)
Leverage	0.0129	0.0118**	0.0170**	0.0126**	0.0143*	0.0212***	0.0127*	0.0095*
	(1.53)	(2.20)	(2.07)	(2.28)	(1.86)	(3.28)	(1.66)	(1.76)
ROA	-0.0177**	-0.0178	-0.0134	-0.0167	-0.0127	0.0141	-0.0110	-0.0230
	(-2.02)	(-0.91)	(-1.37)	(-0.81)	(-1.35)	(0.65)	(-0.82)	(-1.50)
$CAR_{(-205,-6)}$	-0.0019	-0.0021	-0.0015	-0.0032	-0.0020	-0.0036	0.0051	-0.0167***
	(-0.69)	(-0.44)	(-0.54)	(-0.66)	(-0.67)	(-0.85)	(1.58)	(-4.39)
Constant	-0.0199	-0.0316***	-0.0260	-0.0206*	-0.0183	-0.0499***	-0.0454***	-0.0231*
	(-1.12)	(-2.69)	(-1.30)	(-1.71)	(-1.08)	(-3.77)	(-3.27)	(-1.91)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	3285	3609	2893	3201	3375	3582	3123	3640
Adjusted R^2	0.1303	0.0893	0.1040	0.1126	0.1310	0.0997	0.1130	0.1098
Chow Test	20.12		16.79		7.64		2.51	
p-value	(0.000)		(0.000)		(0.006)		(0.113)	