

Bears and Numbers

-Investigating whether short-sellers exploit accounting-based pricing anomalies

by

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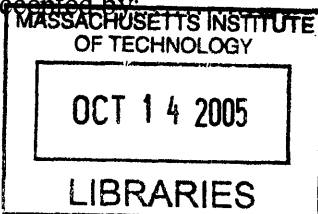
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ABSTRACT

This paper examines whether short-sellers (bears) exploit post-earnings-announcement-drift (PEAD) and the accruals anomaly. I first find that short interest is higher during the period that follows a negative earnings surprise and, to a lesser extent, the announcement of earnings that contains an abnormal income-increasing accrual component. Second, holding both anomalies constant, I find that prices decline more quickly in the presence of higher short interest. However, I do not find that higher short interest improves the pricing of information about future earnings contained in current earnings.

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I. Introduction

This paper examines whether short-sellers (bears) exploit two prominent accounting-based pricing anomalies, namely post-earnings-announcement-drift (PEAD) and the accruals anomaly. In particular, I first examine whether the intensity of shorting is related to the severity of the market's under- and over-reaction to quarterly earnings and accruals, respectively. I find strong evidence that short sellers attempt to exploit underreaction to unexpectedly poor earnings, and I find limited evidence that they exploit overreaction to accruals. Then, holding anomalies constant, I assess whether prices converge more quickly to their fundamental levels in the presence of shorting and find mixed results.

The evidence on whether bears exploit pricing anomalies is mixed. Using the most extensive data set to date, Asquith, Pathak, and Ritter (2004) contest the previously documented underperformance of high short interest stocks. Dechow, Hutton, Meulbroek, and Sloan (2001) document a strong relation between short interest and ratios of fundamentals to prices, suggesting that short-sellers target overvalued companies. As acknowledged by the authors, it is possible, however, that fundamental-to-price ratios such as book-to-market reflect risk factors rather than mispricing, so it is unclear whether short-sellers who trade based on such ratios are

actually exploiting pricing anomalies. By contrast, my study directly examines whether bears exploit anomalies that are uncontroversial.

The most closely-related piece of research to my study is Richardson (2003), who does not find evidence that short-sellers trade on the basis of information contained in annual accruals. However, he studies the accrual anomaly in isolation. Both PEAD and the accrual anomaly are closely related and can either augment or offset each other. Failure to account for their coexistence greatly reduces the power of Richardson (2003)'s tests. In this paper, I study both anomalies on a quarterly basis and control for other determinants of short interest. Therefore I provide more powerful multivariate tests of shorting behavior.

My study is the first to test whether short-sellers help eliminate accounting-based overpricing anomalies. Given the considerable debate within both academic and practitioner circles about the costs and benefits of shorting (see Chancellor, 2001, for a review), this study is of particular interest to regulators and policy makers. I find some evidence that short selling helps to expedite the return of overpriced stocks to fundamental value, but this result is not particularly strong. I also find strong evidence that shorting is *not* associated with price declines in stocks that are *not* overpriced.

The remainder of the paper proceeds as follows: Section II develops my hypotheses and their empirical implications in detail. Section III outlines the sample selection

procedure, defines the variables, and describes the data. In Section IV, I discuss the tests and present empirical results. Finally, Section V concludes.

II. Hypotheses Development

This section is divided into two subsections. The first subsection discusses the interaction between PEAD and the accrual anomalies, which leads to my primary hypothesis on the relation between short interest and accounting information (H1). The second subsection develops my second set of hypotheses on the relation between short interest and price convergence (H2 and H3).

II.1. Shorting and Accounting-Based Anomalies

*Crunching numbers with a computer they took two years to program, Messrs. Jacobs and Levy repeatedly scour 3,000 stocks looking for clues to each issue's future direction ...With six advanced degrees between them, (they) used their academic background in finance and computers to sort out dozens of anomalies supposedly affecting stock-market prices...**The trick, they say, is to weigh many anomalies at once, untangle the effect of one factor from another ...One well-known anomaly is that stocks often decline after companies report disappointing earnings. In anticipation of this anomaly taking among bank stocks last fall, when the economic outlook was highly uncertain, Jacobs Levy sold a lot of bank stocks short. In all, their bank shorts accounted for an unusually large 11% of the firm's portfolio....***"
[emphasis added]

- James White, The Wall Street Journal, March 20, 1991

This subsection first discusses the interaction between the PEAD and accrual anomalies, and then develops my primary hypothesis on the relation between short interest and accounting information.

PEAD and the accrual anomaly are two prominent pricing anomalies that are based on closely related pieces of accounting data. PEAD refers to the phenomenon wherein stocks experience prolonged positive and negative abnormal returns (i.e. “drift”) during the two to three quarter period following the release of, respectively, unexpectedly good and bad earnings news (i.e. “earnings surprise”).¹ The accrual anomaly refers to the negative relation between the current level of accruals and subsequent abnormal returns. Initial overreaction to accruals reverses when earnings are reported in the following periods and the market learns that the accruals of the previous period are not sustainable (e.g., Sloan, 1996).

Analyzing either one of the two aforementioned accounting-based anomalies in isolation is problematic because the level of accruals embedded in earnings surprises can either mitigate or exacerbate the amount of drift that follows an earnings surprise (Collins and Hribar, 2000). If firms manage accruals to achieve earnings surprises, the PEAD and the accrual anomaly tend to *offset* each other. Large negative (positive) earnings surprises forecast negative (positive) abnormal returns subsequent to the earnings announcement, but large negative (positive) accruals, which can cause earnings to be lower (higher) than expected, forecast positive (negative) abnormal returns. In contrast, if managers use accruals to smooth earnings, the accrual mispricing effect tends to *augment* the drift that follows an earnings surprise. Large negative earnings surprises forecast negative abnormal returns, which would be augmented if large positive accruals were present. Similarly, large positive earnings

¹ Ball and Brown (1968) were the first to detect the PEAD anomaly. Bernard and Thomas (1989 and 1990) provide the most comprehensive documentation.

surprises forecast positive abnormal returns, which would be augmented if negative accruals were present. Following Collins and Hribar (2000), I jointly study both the accruals and PEAD anomalies, thereby increasing the power of my tests.

<Insert Figure 1 about here>

Figure 1 presents a summary of the above discussion and shows my predictions. If bears are sophisticated investors who benefit from price declines (Dechow et al., 2001; Desai et al., 2002), I expect them to take advantage of the predictable extreme negative returns of stocks with positive accruals and negative earnings surprise, so long as they do not perceive such stocks to be much riskier than others. Thus, controlling for the transaction costs associated with shorting and other determinants of short interest, I expect to observe higher short interest among the stocks with the most extreme positive accruals and negative earnings surprises. The persistence of overpricing even in the presence of significant shorting activities would indicate that other obstacles prevent the informational market inefficiencies from being arbitrated away. For instance, Mashruwala, Rajgopal and Shevlin (2004) suggest that idiosyncratic volatility could be one such an obstacle.

On the other hand, finding that accounting anomalies do not cause cross-sectional variation in short interest would also be interesting. I propose two potential explanations. First, it might be that bears are not exploiting these well-documented anomalies because of risks or costs that I cannot observe. Alternatively, short interest might be a noisy proxy for the presence of bearish views. Shorting occurs for many reasons other than bears' view that the stock is overpriced. For example, market

makers and block traders will short for technical reasons in order to maintain liquidity. To the extent that shorting is also attributable to these other activities, the power to detect attempts to exploit accounting-based overpricing is reduced.

Hence my first hypothesis, which I henceforth refer to as the Short Seller Exploitation Hypothesis, or H1, is formally stated as follows:

H1: Negative earnings surprises and income-increasing accruals should be followed by high short interest. Furthermore, I expect the accruals and earnings surprise effects to augment each other.

II.2 Shorting and Market Efficiency

“To enjoy the advantages of a free market, one must have both buyers and sellers, both bulls and bears. A market without bears would be like a nation without a free press. There would be no one to criticize and restrain the false optimism that always leads to disaster.”

– Bernard Baruch, testimony before the Committee on Rules, House of Representatives, January 1917.

This subsection develops my hypotheses on the relation between short interest and price convergence. I first postulate that high short interest reduces the degree to which the market is surprised by subsequent earnings announcements. I also postulate that short interest expedites the rate at which prices move to the level where they correctly reflect income-increasing accruals and negative earnings surprise.

If the efficient market hypothesis holds, rational speculative activity should eliminate mispricing (Fama, 1965). There is a voluminous literature on different market

participants exploiting anomalies, whether they are institutions, analysts, or insiders (e.g. Collins, Gong, and Hribar, 2003; Ke and Gowda, 2004; Barth and Hutton, 2004; Ayers and Freeman, 2003; Kolasinski and Li, 2004). However, less attention is paid to short sellers, though shorts are an integral part of the market. If shorting causes negative information contained in current earnings news to be better reflected in prices, then under/overreaction to earnings/accruals should be more short-lived among stocks with higher short interest ratios. On the other hand, even if short interests are high, the presence of short sale constraints may not allow it to be high enough to bring the price down. Therefore whether short interest is associated with faster price declines remains an empirical question.

I examine the effect of short interest on pricing by testing two hypotheses, which I discuss in sequence. The first of the two, which I label H2, is motivated by the fact that current earnings contain information about future earnings. Hence if shorting causes a stock's price to better reflect the current period's negative earnings surprise and income-increasing accrual component, it should also cause the price to better reflect rational expectations about future earnings. Hence my second hypothesis, which I henceforth refer to as the Anticipation Enhancement Hypothesis, or H2, is formally stated as follows:

H2: Stocks that experience a negative earnings surprise and income increasing accruals and are subsequently heavily sold short will experience a less intense

price reaction around future earnings announcements than those less heavily sold short.

Underreaction to negative earnings surprise results in long-run negative abnormal returns as prices tend move to the point at which they fully incorporate the negative information. Likewise, mispricing of income-increasing accruals results in long run negative abnormal returns as the market slowly begins to recognize that such accruals are subject to reversal. If shorting, by reducing net demand, helps more quickly move prices to their fundamental value, it should cause such abnormal returns to be realized sooner, especially during the time when short positions are accumulated. Hence my third hypothesis, which I henceforth refer to as the Price Decline Expediting Hypothesis, or H3, is formally stated as follows:

H3: High short interest should cause more of the long-run negative abnormal return associated with negative earnings surprises and income-increasing accruals to occur over a shorter horizon, particularly during the period when short sellers establish their positions.

III. Data

This section outlines the sample selection procedure, defines the variables, and describes the sample.

III.1. Sample Selection

My sample selection procedure consists of the four stages outlined below.

First, I obtain quarterly earnings announcement dates for each non-financial NASDAQ firm in the Compustat database with a December fiscal year-end over the 1995-2003 period.² NASDAQ defines short interest as the total number of shares sold short over a one-month period, and it makes this data publicly available on a monthly basis from October 1995 to June 2004, inclusive. Hence, for each firm-quarter observation, I obtain short interest data from NASDAQ for the nearest month-long period that begins after the earnings announcement date.

Second, to calculate earnings surprise, I require firms to have at least six quarters of data on earnings before extraordinary items and discontinued operations. Six consecutive quarters, from $t-6$ to $t-1$ (the estimation period), are required to estimate the parameter of the seasonal random-walk-with-drift model. I then use the model to estimate expected earnings for quarter t (the event quarter). Earnings of quarter t are required to compute the earnings surprise in the event quarter.

Third, to compute performance-matched discretionary accruals, I require each firm-quarter observation to have data on earnings report dates, total assets, current assets, cash, sales, accounts receivable, and current liabilities. I exclude from my sample all firm-quarter observations for which there are fewer than ten industry peer firms, defined by 2-digit SIC codes, in that quarter in the entire Compustat universe.

² I only include firms with December fiscal year end to get around the seasonality issues arising from quarterly accrual calculations.

Finally, I obtain from CRSP daily returns over the period beginning four days prior to the earnings announcement and ending 182 days after. These data requirements allow me to compute the daily size-adjusted abnormal returns. The above criteria yield 39,955 firm-quarter observations covering 2,476 distinct firms.

III.2. Variable Definitions

III.2.1. Accruals:

I measure discretionary accruals by employing the Jones (1991) model using the modifications suggested by DeFond and Jimbalvo (1994) and Dechow, et al. (1995). In addition, following Kothari et al (2004) and Louis (2004), I adjust each firm's discretionary accrual by subtracting the average discretionary accrual of a performance-matched portfolio of firms. I now describe this procedure in detail.

First, I categorize firms into different industry groups based on their two-digit SIC code. Next, I estimate the following cross-sectional regression model for each industry group for each quarter:

$$\frac{ACC_{jt}}{TA_{jt-1}} = \alpha_1 \left(\frac{1}{TA_{jt-1}} \right) + \alpha_2 \left[\frac{(\Delta REV_{jt} - \Delta REC_{jt})}{TA_{jt-1}} \right] + \alpha_3 \frac{(PPE_{jt})}{TA_{jt-1}} + \varepsilon_{jt} \quad (1)$$

Where ACC = total accruals in the current quarter, which I measure as the change in current assets net of change in cash, minus the change in current liabilities, net of the change in the current portion of long term debt.

TA = total assets at the beginning of the quarter;

ΔREV = change in revenue from the last quarter;

ΔREC = change in receivables from the last quarter;

PPE = gross PPE in the current quarter.

The residuals from the model correspond to firms' discretionary accruals in a given quarter. Finally, for each quarter, I group firms into portfolios based on their return on assets (ROA) and take the average discretionary accrual for each portfolio within each quarter. The difference between an individual's firm's discretionary accrual for a given quarter and the mean discretionary accrual of its corresponding ROA portfolio is defined as its performance-matched discretionary accrual. I use performance-matched discretionary accruals in all my tests, and henceforth refer to them simply as "accruals."

I use the Louis (2004) procedure to calculate performance-matched accruals because the alternative method suggested by Kothari et al (2004) is only applicable for a small, random sample of firms. Kothari et al (2004) first randomly select a sample of 100 firms and then adjust the discretionary accruals for each sample firm by subtracting the discretionary accrual of the firm outside the sample with the closest ROA. So long as the sample is small and random, firms inside and outside the sample with similar ROA are likely have comparable performance-related accruals, and hence the adjustment is valid. However, this is not likely to be true where, as in my case, the sample is large and non-random, and hence not representative of the universe of firms. Since my sample includes all NASDAQ firms, a sample firm's performance-related accrual is far more likely to be comparable to that of an ROA portfolio taken from the whole COMPUSTAT universe than to that of an individual firm not on NASDAQ.

III.2.2. Standardized Unexpected Earnings:

Following Bernard and Thomas (1990), I assume earnings for each firm follow the seasonal random-walk-with-drift process given below:

$$E(Q_{i,t}) = Q_{i,t-4} + \delta_i + \varepsilon_t, \quad (2)$$

Where Q_{it} are the earnings for firm i in quarter t and δ_i is the drift parameter. For each firm-quarter observation, I estimate δ_i using a minimum of 6 quarters and a maximum of 10 quarters of historical earnings data. I then estimate expected earnings for quarter t using this parameter, and set unexpected earnings equal to actual earnings less expected earnings. I also estimate the standard deviation of unexpected earnings over this estimation period. Finally, I compute standardized unexpected earnings (*SUE*) by dividing unexpected earnings by their standard deviation. Thus *SUE* is defined by the equation below:

$$SUE_{i,t} = (Q_{i,t} - E(Q_{i,t})) / \sigma[Q_{i,t} - E(Q_{i,t})] \quad (3)$$

I use the seasonal random-walk-with-drift model rather than analyst forecasts to estimate unexpected earnings because this method is the standard in the literature. In addition, since many NASDAQ firms are not covered by analysts, I would lose an unacceptably large number of observations if I were to use analyst forecasts to estimate unexpected earnings.

III.2.3. Short Interest:

NASDAQ compiles and reports short interest as the total number of shares sold short within the month-long period that ends as of the 15th of each month or, if the 15th is not a trading day, the last trading day before the 15th. I define relative short interest

as short interest divided by the total number of shares outstanding as of the end of the quarter. I expect short sellers to establish short positions in stocks with negative earnings surprise and income-increasing discretionary accruals, which they should be able to detect on the earnings announcement date. Thus, I restrict my attention to short interest data corresponding to the nearest month-long period that begins after the earnings announcement date to make sure that both earnings and accrual information are publicly available before the recorded short positions are taken.

<Insert Figure 2 about here>

In Figure 2, I plot the equal-weighted mean short interest per share on a quarterly basis over the interval 1995-2003 for all NASDAQ companies. As can be seen, aggregate short interest per share declines substantially as the dot-com bubble expands upward from mid-1998 to its peak in early 2000; it then rebounds sharply as the bubble explodes over the subsequent two years. Aside from this time-series pattern, it is also worth noting that remarkably little short-selling takes place at any point in the cycle. The aggregate NASDAQ short interest ratio averages 2.5 percent over my sample period, and never exceeds 4 percent.

<Insert Figure 3 about here>

Figure 3 illustrates the histogram of relative short interest for the data panel. The height of each bar indicates the number of firm-quarter observations for which relative short interest is contained in the range indicated on the x axis. For example, the first bar includes firm-quarters where the short position is greater than 0 but less than 0.50%, and the second bar includes firm-quarters where the short position is greater than 0.50% but less than 1.00%, and so on. The figure documents that the

distribution is highly skewed, with few firms having short positions in excess of 1.5 percent of shares outstanding.

III.2.4. Abnormal Returns

I apply return tests to analyze the influence of short selling activity on market efficiency. I calculate the abnormal returns for my tests as follows.

First, following Bartov et al. (2000), I measure the market's reaction to earnings news at the subsequent three earning announcement dates. Specifically, for each of the quarters $t+1$ through $t+4$, I measure the size-adjusted return during the three-trading-day window around the earnings announcement. I denote the return around the earnings announcement of quarter $t+i$ for firm j as $R_{j(t+i)}$. Designating the current earnings announcement date as day 0, I begin each return window on the day before the announcement to allow for information leakage and end it on day 1 to ensure that the market has had enough time to react. I then sum the first three future quarterly announcement returns and subtract the fourth future quarterly announcement return. I define this quantity as *REACT* and I use it to test the impact of high short interest on price convergence. React is thus given by the following equation:

$$REACT_{jt} = R_{j(t+1)} + R_{j(t+2)} + R_{j(t+3)} - R_{j(t+4)} \quad (4)$$

In view of the fact that current earnings contain information about future earnings, if shorting causes a stock's price to better reflect the current period's negative earnings surprise and income-increasing accrual component, it should also cause the price to better reflect rational expectations about future earnings. Therefore holding bad earnings news and income increasing accruals constant, stocks that are more heavily

sold short should experience a less negative price reaction around future earnings announcement.

Secondly, I compute the cumulative size adjusted return over the period beginning on day 2 and ending on day 180 for each firm-quarter and denote it as R_{180} . This 180-day period roughly corresponds to the period during which the bulk of abnormal returns associated with PEAD and the accrual anomalies are realized (Defond and Park, 2001). I also compute cumulative abnormal returns for the period beginning on day 2 and ending one day before the short interest report date. I call this period the short interest accumulation period and label the corresponding return as R_{SI} .

<Insert Figure 4 and Figure 5 about here>

If shorts improve the informational efficiency of the market by providing downside price pressure, they should cause a greater proportion of the abnormal returns associated with bad earnings news and income increasing accruals to be realized sooner. Hence, holding R_{180} constant, I expect R_{SI} to be more negative for stocks whose short positions are more rapidly being accumulated.

III.3. Description of the Sample

Table 1 provides descriptive statistics for the final sample. I winsorize all the variables at 1% and 99% level, except for the *mktvalue* variable, for which I use the log value in the regression. As may be expected when accounting data are pooled over time and across firms, variables do not have smooth distributions. To alleviate problems associated with non-smooth distributions, in the tests that follow I use

categorical classifications for the main explanatory variables (i.e., *Suedecile* and *Pmdadecile*). The mean short interest per share is 2.2 percent, and the median is 0.4 percent. This is mainly due to the fact that a few firms have very high short interest. The mean SUE is -0.03 and the median is 0.02, which are close, so the distribution is approximately symmetric around the mean. The same is the true for performance-matched discretionary accruals, which have a mean of 0.02 and a median of 0.00. The market value variable is skewed to the right as evidenced by the large difference between the mean (658.93) and median (106.04). This nonsymmetry is due to the presense of a small number of very large large firms, such as Microsoft. Trading volume is also skewed to the right, indicating that a small number of firms have relatively large trading activity. Book-to-Market ratio and all return variables are approximately symmetric.

IV. Tests and Results

My analysis consists of two parts. First I examine whether high accruals and negative earnings surprise are associated with high short interest. Second, I investigate whether high short interest improves the pricing of unexpectedly low earnings and high accruals. Below I discuss the details of how I test my hypotheses.

IV.1. Test of whether short interest is associated with negative SUE and income-increasing accruals

As stated in section II.1, my first hypothesis, in alternative form, is

H1: Negative earnings surprises and income-increasing accruals should be followed by high short interest, and the two effects should augment each other.

I test H1 by regressing short interest on SUE and Accrual deciles. I specify the regression as follows:

$$sips = \alpha + \beta_1 * suedecilerv + \beta_2 * pmdadecile + \beta_3 * suedecilerv * pmdadecile + \beta_4 * Lnmv + \beta_5 * BM + \beta_6 * Volps + \varepsilon \quad (5)$$

- Where *sips* = Short interest per share: the ratio of the number of shares shorted in the month after quarterly earnings announcement, deflated by the number of shares outstanding at the end of the quarter;
- suedecilerv* = Reversed decile rank of sue from 10 to 1, 10 being the lowest sue and 1 being the highest;
- pmdadecile* = Decile rank of pmda from 1 to 10, 1 being the lowest and 10 the highest;
- Lnmv* = Log of market value of equity for current quarter;
- BM* = Book-to-market ratio measured at the end of quarter t;
- Volps* = Trading volume: the average daily trading volume as reported on the NASDAQ monthly short interest report deflated by the number of shares outstanding.

I use the decile rankings of accruals and SUE, rather than their actual values, as explanatory variables because their relations with short interest are unlikely to be linear. To compute *pmdadecile*, for each calendar quarter I rank firms according to their accruals. If a firm's accruals are in the highest decile for a given quarter, *pmdadecile* will take on a value of ten, and if they are in the lowest decile, *pmdadecile* will take on a value of one. To compute *suedecilerv*, for each quarter I rank firms according to their SUE in descending order. Thus, if a firm's SUE is in the highest decile, *suedecilerv* will take on a value of one, and if it is in the lowest decile it will take on a value of ten. I order the SUE deciles in this manner so that *suedecilerv* has the same directional effect on short interest as does *pmdadecile*.

H1 predicts positive coefficients on the *suedecilerv* (β_1) and on the *pmdadecile* (β_2) since it postulates that low SUE and high accruals are associated with more short selling. If the two effects augment each other, the interaction term *suedecilerv***pmdadecile* (β_3) should be positive as well. The interaction term captures the marginal effect of accruals on the slope of the earnings surprise and vice versa.

I estimate equation (5) and all other regression models using the Fama-MacBeth procedure. Thus I ensure that cross-sectional correlations in the error terms do not bias my standard error estimates. To implement this procedure, I run cross-sectional regressions for each calendar quarter and obtain a time series of coefficient estimates. I then compute the mean and standard error for each coefficient from this time series.

In the above and all following regressions, I use three control variables LNMV, BM, and VOLPS. I now discuss each of them below.

Size (LNMV)

Sias and Starks (1997) document that institutional ownership and firm size are correlated. Large firms are likely to have high institutional ownership, which is in turn correlated with the number of stocks available to be borrowed and sold short. Thus, I use firm size to control for the availability of loanable shares in the

regression. As a result, I expect β_4 in equation (5) to be positive. I measure firm size as the log of market value of equity at the end of the current quarter.

Book-to-market (BM)

Dechow et al. (2001) find that short sellers are most active in growth firms (as measured by low book-to-market ratios). A low book-to-market ratio also indicates that a firm may be overvalued and therefore a target for short sellers. I expect β_5 in equation (5) to be negative since B/M has been documented to be positively associated with short selling.

Liquidity (VOLPS)

Stocks with high trading volume are more liquid. Graham, et al. (1999) argue that short sellers are more likely to trade in stocks with lower transaction costs. Short interest is expected to be higher for stocks with high trading volume. I include the monthly average daily trading volume per share in the regression to control for liquidity. I expect the coefficient corresponding to this variable, β_6 in equation (5) to be positive.

<Insert Table 2 about here>

Using a sample of 39,955 firms-quarters, I estimate model (5) using the previously described Fama-MacBeth procedure. I estimate the quarterly cross-sectional analysis using OLS. Table 2 reports the results. I find a significantly positive relation between the reversed decile rank of SUE and the short interest level. The parameter estimate of 0.0004 implies that if two stocks are similar except for one ranking difference in

their standardized unexpected earnings, the stock with the lower SUE has short interest that is on average 0.04 percentage points higher. I conclude that some short selling is motivated by negative earnings surprise, confirming H1. The regression has an R^2 of 0.39, which seems reasonable.

The results also suggest that short interest is not regularly affected by performance-matched accruals, confirming Richardson (2003), who finds similar results using two different measures for accruals. The mean standard error of the coefficient on the accruals decile is comparable to that of the SUE decile. Therefore power is unlikely to be the reason for not finding a relation between accruals and short interest.

The estimated coefficient on the interaction term is insignificant, which suggests that accruals do not augment the SUE effect on short interest. The estimated coefficients on the control variables (firm size, Book-to-market, and liquidity) all have predicted sign and are highly significant, both statistically and economically.

Since the relation between accounting variables and short interest may be non-linear, I also employ logistic regression analysis to test H1. Following Asquith et al. (2004), I define a variable *Highsi* which equals 1 if short interest per share for a particular firm-quarter observation falls above the 95th percentile of the whole sample and zero otherwise. I then estimate a logistic model in which I use *Highsi* as the dependent variable and all the same independent variables that I used in the OLS analysis. H1

makes the same predictions for the logistic parameter estimates as it does for those of the OLS analysis.

<Insert Table 3 about here>

Table 3 reports the results for the logistic model. Here, both earnings surprise and accruals are statistically significant and have the predicted sign. The parameter estimates for earnings surprise and accruals are 0.06 and 0.04, respectively, which correspond to odds ratios of 1.06 and 1.04. Thus short interest is 6% and 4% more likely to be high (i.e. above the 95th percentile cutoff) when SUE falls one decile lower and accruals rise one decile higher, respectively. The interactive term has the wrong sign but is not statistically significant. Again, all the control variables have the predicted sign and are significant.³

Taken together, the OLS and Logistic analyses in Tables 2 and 3 provide evidence that short interest can be partly explained by information about future earnings contained in current quarter earnings, namely, earnings surprise and accruals. Next, I proceed to investigate whether more intensive short selling activity improves the pricing of these two anomaly indicators.

IV.2. Tests of whether shorting expedites price declines

I test H2 by estimating the following regression model:

³ The result for the accruals parameter is sensitive to how I define *Highsi*. If I define *Highsi* such that it equals one when short interest per share is above some other cutoff points used in the short interest literature, other than the 95th percentile, I find that the accruals parameter ceases to be statistically significant. Specifically, I find no statistically significant relation between *Highsi* and accruals when using the 90th percentile as a cutoff point. I also find no relation when I define *Highsi* to equal one when the value of SI is above 10%.

$$\begin{aligned}
React = & \alpha + \beta_1 sips + \beta_2 suedecilerv + \beta_3 pmdadecile + \beta_4 sips * suedecilerv + \\
& \beta_5 sips * pmdadecile + controls + \varepsilon
\end{aligned} \tag{6}$$

- Where *React* = The sum of the market reactions to earnings announcements in the next three quarters, quarters t+1 to t+3, minus the market reaction to the earnings announcement in quarter t+4. The market reaction in each quarter is defined as the cumulative size-adjusted return over the three trading day window that begins one trading day before the earnings announcement;
- sips* = Short interest per share: the ratio of the number of shares shorted in the month after quarterly earnings announcement, deflated by the number of shares outstanding at the end of the quarter;
- suedecilerv* = Reversed decile rank of sue from 10 to 1, 10 being the lowest sue and 1 being the highest;
- pmdadecile* = Decile rank of pmda from 1 to 10, 1 being the lowest and 10 the highest.

The interaction terms between *sips* and the two anomaly indicators capture the effect of short interest on market reactions to future earnings announcements above and beyond what is predicted by the accruals and earnings surprise variables. If high short interest indeed reduces future negative price reaction of stocks that have underreacted to earnings surprise or overreacted to accruals, I expect to find β_4 and β_5 to be positive and statistically significant. Table 4 below contains the results of my tests of H2.

<Insert Table 4 about here>

The results in Table 4 indicate that H2 is not supported. The coefficients for β_4 and β_5 are not significant. Furthermore, neither *short interest per share* nor *pmdadecile* is significant. This result is robust to different specifications for short interest (not tabulated), including decile ranks and highsi dummies constructed with different

cutoffs. Consistent with prior literature (Bernard and Thomas, 1990), the coefficient that corresponds to *suedecilerv* is persistently negative and significant at the 1% level. The parameter estimate of negative 0.0025 implies that if two stocks are similar except for one ranking difference in their standardized unexpected earnings, the stock with the lower SUE (higher *suedecilerv*) has future market reaction that is on average more negative by 0.25 percentage points.

As discussed in section 2, hypothesis H3 postulates that high short interest following earnings announcements should accelerate the realization of negative abnormal returns that result from any mispricing of earnings information. In particular, more of the negative abnormal return should be realized during the time in which short interest is being accumulated. To test H3, I run the following regression:

$$R_{st} = \alpha + \beta_1 sips + \beta_2 suedecilerv + \beta_3 pmdadecile + \beta_6 R180 + controls + \varepsilon \quad (7)$$

- Where R_{st} = Cumulative, size-adjusted return over the period beginning 2 days after the earnings announcement and ending 1 day before the first short interest reporting date that comes after the earnings announcement date;
- sips* = Short interest per share: the ratio of the number of shares shorted in the month after quarterly earnings announcement, deflated by the number of shares outstanding at the end of the quarter;
- suedecilerv* = Reversed decile rank of sue from 10 to 1, 10 being the lowest sue and 1 being the highest;
- pmdadecile* = Decile rank of pmda from 1 to 10, 1 being the lowest and 10 the highest.

I start the short interest accumulation period two days after the earnings announcement to allow for initial reaction and digestion of the earnings information.

I end the period one day before the short interest report date to remove the price reaction to the short interest information itself.

To identify the effect of shorting on the speed of the price convergence, I examine the effect of *sips* on R_{si} controlling for the 180 day abnormal return (R_{180}).⁴ Thus I test whether higher *sips* causes more of the abnormal return during the 180 day period to get realized during the short interest accumulation period. If high short interest indeed expedites price convergence, I expect to find β_1 to be negative and statistically significant.

I run the regression with and without the two anomaly indicators because they also predict R_{SY} to some extent. However, as shown in table 5, their influence on R_{SY} is swamped by that of R_{180} .

<Insert Table 5 about here>

Results in Table 5 support H3. The coefficient on short interest per share is negative and significant most of the time as predicted by the model (Columns 2 – 5). In all but one regression, it equals approximately -0.21. A coefficient estimate of this magnitude implies that if two stocks are similar except for a one percentage point difference in their short interest per share, the stock with the higher short interest will experience a cumulative abnormal return lower by 21 percentage points while short interest is being accumulated. Note that the coefficient on short interest is not

⁴ The 180 day period roughly corresponds to the period during which the bulk of the negative abnormal returns predicted by the two anomalies get realized.

significant in the regression where R180 is omitted as a control (column 1). Thus short selling does not drive the price unconditionally.

One complication arises when testing the effect of shorting on prices convergence to fundamental values – both factors are endogenously determined. If short sellers short stocks that are more likely to have a speedy price decline, I expect a negative relation between the speed of price decline and short interest, even if the latter has no effect on the former. Thus my finding that the two are negatively correlated two could be interpreted either as evidence that shorting improves pricing, or that short sellers are better able to spot overpriced stocks that are likely to have a quicker price decline. Distinguishing between these two competing hypotheses would require finding instruments that help determine short interest but not the speed of price convergence. One potential candidate is the supply of loanable shares, which is highly proprietary. I leave the task of disentangling this endogeneity problem to future research.

V. Conclusions

This paper contributes to the short interest literature on both the determinants of and the consequences of short interest. It is the first to document that short sellers, trading after the earnings announcement, attempt to exploit market underreaction to negative earnings surprise. In contrast to Christophe, et al. (2004), who document that short sellers anticipate earnings surprise, I find that short sellers trade on earnings news even after it has been made public. This paper is also the first to test how PEAD and accruals jointly affect short interest, in contrast to Zhang and Cready (2004) and

Richardson (2003), who test the effect of accruals in isolation. Finally, this paper is the first to test and provide limited evidence that short sellers help move prices to levels where they better reflect earnings information.

To the extent it documents how shorting affects price formation in the presence of mispricing anomalies, this paper should interest policy makers. Effective January 3, 2005, the SEC has adopted the suspension of the current “up-tick” rule, among other changes, to reduce the cost associated with shorting (“Regulation SHO”). My finding that short-sellers appear to have a beneficial effect on the informational efficiency of prices has direct bearing on the importance of this reform.

This last finding, however, is not strong. I find that stocks with negative abnormal returns following an earnings announcement tend to see those returns get realized more quickly if short interest is high. This result could indicate that short sellers help move prices to fundamental value more quickly. Unfortunately, it could also indicate that, holding overpricing constant, short sellers tend to pick those overpriced stocks that are likely to converge more quickly. Differentiating between these equally plausible interpretations of my results requires finding instrumental variables that help determine short interest but do not affect the speed of price convergence. One possible instrument would be the supply of loanable shares. I leave it to future researchers to find and utilize such instruments.

I also do not find that greater short interest causes prices to better anticipate future earnings surprises. This result, however, is also far from conclusive. The failure to reject the null in this case may be due to measurement error in my short interest variable, which would tend to bias the estimated effect to short interest toward zero. The lump-sum short interest data I use is highly noisy and of low frequency. In addition, as previously indicated, a large proportion of short interest reflects many institutions shorting for technical reasons that have nothing to do with them having bearish views about a stock. Only when clean measures of bearish shorting are found can the costs and benefits of shorting be well assessed. Unfortunately, refining the short interest variable requires highly proprietary data, which is beyond the scope of current paper. One potential refinement would include distinguishing between different shorting types, such as market maker shorting and speculative shorting. I leave it to future research to further explore such data refinements.

The power of my tests could be improved by controlling for factors that make stocks more or less difficult to short. For instance, it would be useful to control for whether stocks have traded option or convertible securities since such securities reduce the costs of shorting. Institutional holdings could be used to control for the supply of loanable shares. Finally, it would be useful to add controls for the level of information asymmetry, such as analyst following. I leave it to future researchers to explore these power-enhancement possibilities.

References

- Asquith, P., P. Pathak, and J. Ritter (2004). "Short Interest and Stock Returns." NBER working paper.
- Ayers, B. and R. Freeman (2003). "Evidence that Analyst Following and Institutional Ownership Accelerate the Pricing of Future Earnings." *Review of Accounting Studies* 8, 47-67.
- Barth, M. and A. Hutton (2004). "Analyst Earnings Forecast Revisions and the Pricing of Accruals." *Review of Accounting Studies* 9, 59-96.
- Bartov, E., S. Radhakrishnan, and I. Krinsky, 2000, "Investor sophistication and patterns in stock returns after earnings announcements." *The Accounting Review* 75, 43-63.
- Baruch, B. (1917). "Testimony before the Committee on Rules." House of Representatives.
- Berenson, A. (2003). *The Number: How the Drive for Quarterly Earnings Corrupted Wall Street and Corporate America* (Random House, New York).
- Chancellor, E. (2001). "A Short History of the Bear." Guest Analysis, www.theprudentbear.com, October 29. P6.
- Chanos, J. (2003). "Hedge Funds Strategies and Market Participation." Comments for the SEC Roundtable on Hedge Funds.
- Chen, H. and V. Singal (2003). "Role of Speculative Short Sales in Price Formation: Case of the Weekend Effect." *Journal of Finance* 58, 685-705.
- Christophe, S., M. Ferri, and J. Angel (2004). "Short-Selling Prior to Earnings Announcement." *Journal of Finance* 59, 1845-75.
- Collins, D. and P. Hribar (2000). "Earnings-based and Accrual-based market anomalies: one effect or two?" *Journal of Accounting and Economics* 29, 101-23.
- Collins, D., G. Gong, et al. (2003). "Investor Sophistication and the mispricing of accruals." *Review of Accounting Studies* 8, 251-276.
- Dechow, P., A. Hutton, et al. (2001). "Short-sellers, Fundamental Analysis and Stock Returns." *Journal of Financial Economics* 61, 77-106.
- Desai, H., K. Ramesh, et al. (2002). "An Investigation of the Informational Role of Short Interest in the Nasdaq Market." *Journal of Finance* 57, 2263-87.

Jones, C. M. and O. Lamont (2002). "Short Constraints and Stock Returns." *Journal of Financial Economics* 66, 207-239.

Ke, B. and S. Gowda (2004). "Do Institutional Investors Exploit the Post-Earnings Announcement Drift?" *Journal of Accounting and Economics*, forthcoming.

Kolasinski, A. and X. Li (2004). "Insider Trading and Post-Earnings Announcement Drift." MIT working paper.

Kothari, S. (2001). "Capital Markets Research in Accounting." *Journal of Accounting and Economics* 31, 105-231.

Kogan, L., S. Ross, J. Wang and M. Westerfield (2003). "The Price Impact and Survival of Irrational Traders." MIT working paper.

Mashruwala, Rajgopal, and Shevlin (2004). "Why is the Accrual Anomaly not Arbitraged Away?" University of Washington working paper.

Nagel, S. (2004). "Short Sales, Institutional Investors, and the Cross-Section of Stock Returns." *Journal of Financial Economics*, forthcoming.

Ofek, E., M. Richardson, et al. (2003). "Limited Arbitrage and Short Sales Restrictions: Evidence from the Options Markets." *Journal of Financial Economics* 74, 305-342.

Richardson, S. (2003). "Earnings Quality and Short Sellers." *Accounting Horizons* supplement: 49-61.

Zhang, Y. and Cready, W. (2004) "Do Speculative Short Sellers Detect Earnings Management?" working paper.

Figure 1

Accounting Performance and Pricing Anomalies

Earnings Surprise

Positive

Negative

Positive
Accruals
Negative

O	Negative Future Returns High Short Interest
Positive Future Returns Low Short Interest	O

Figure 2
Mean short interest per share over the sample period of 1995 – 2003

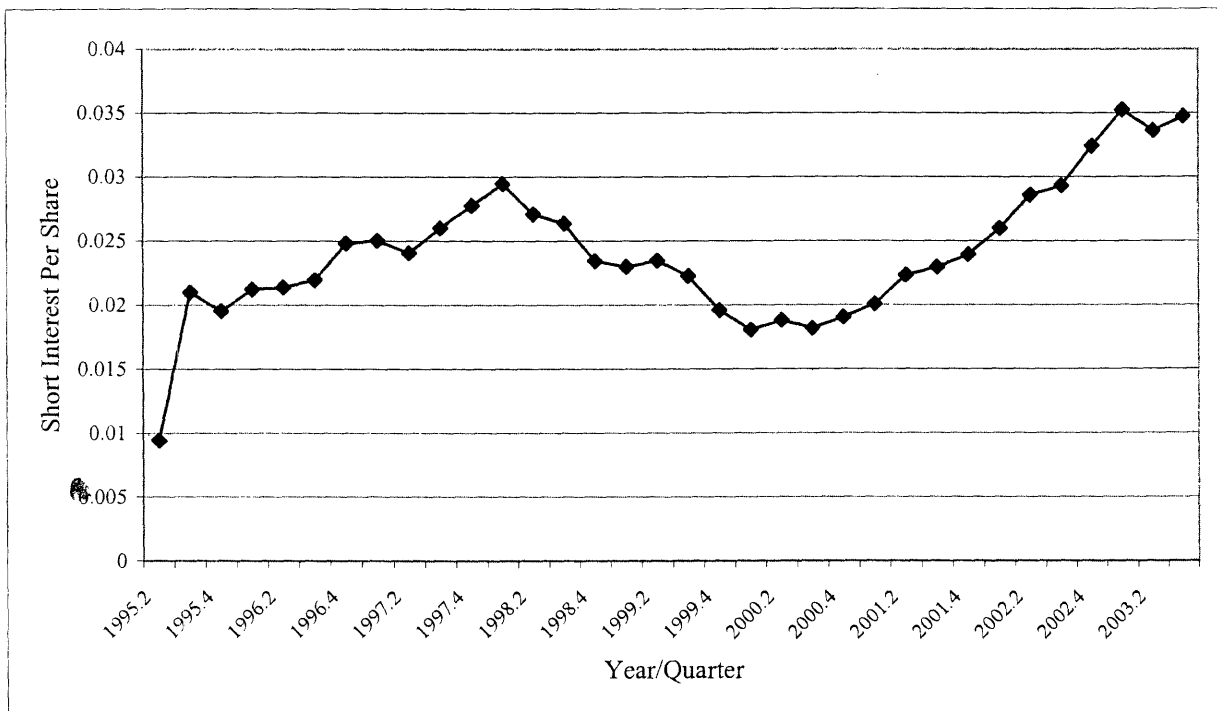


Figure 3
Histogram of Short Interest Positions

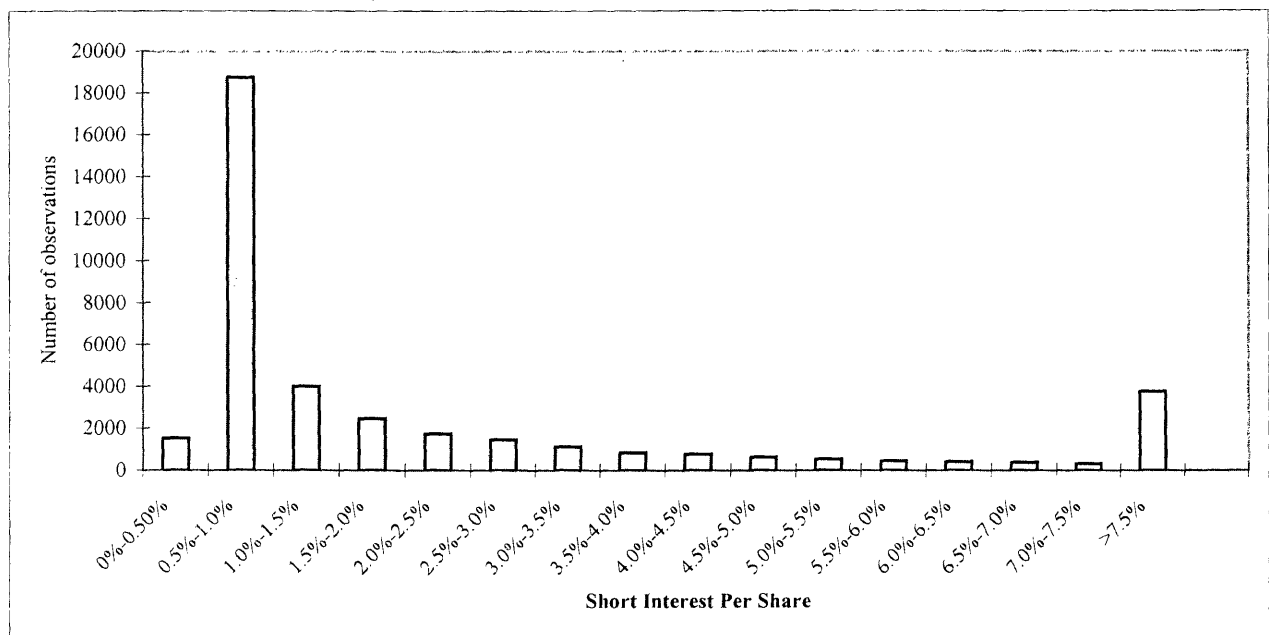
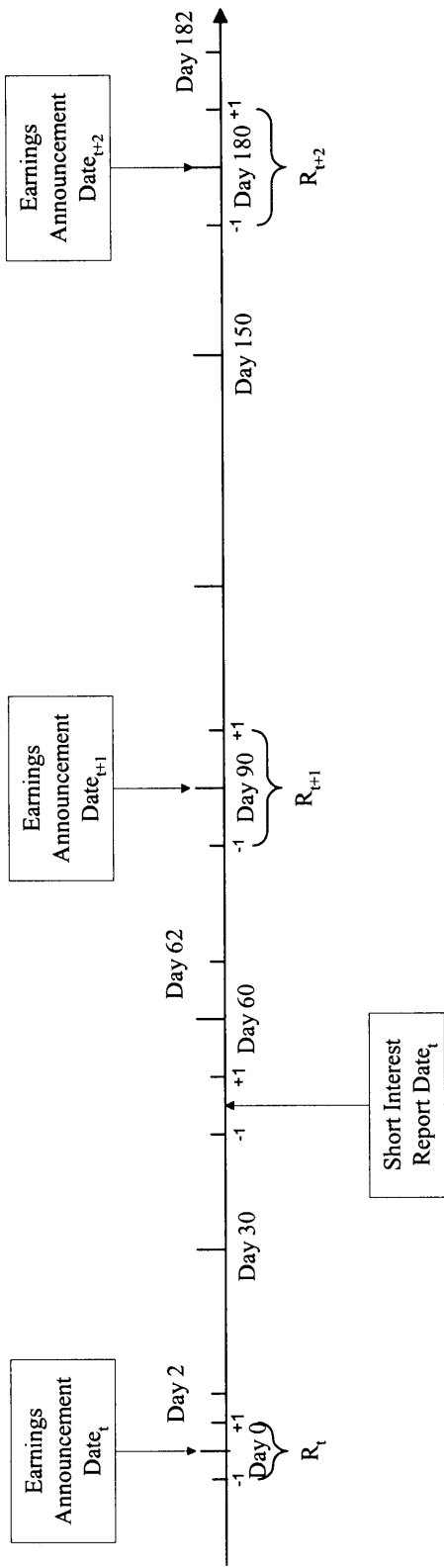


Figure 4
Timeline for the Anticipation Enhancement Hypothesis (H2)



$$\text{Market Reaction (REACT)} = R_{t+1} + R_{t+2} + R_{t+3} - R_{t+4}$$

Figure 5
Timeline for the Price Decline Expediting Hypothesis (H3)

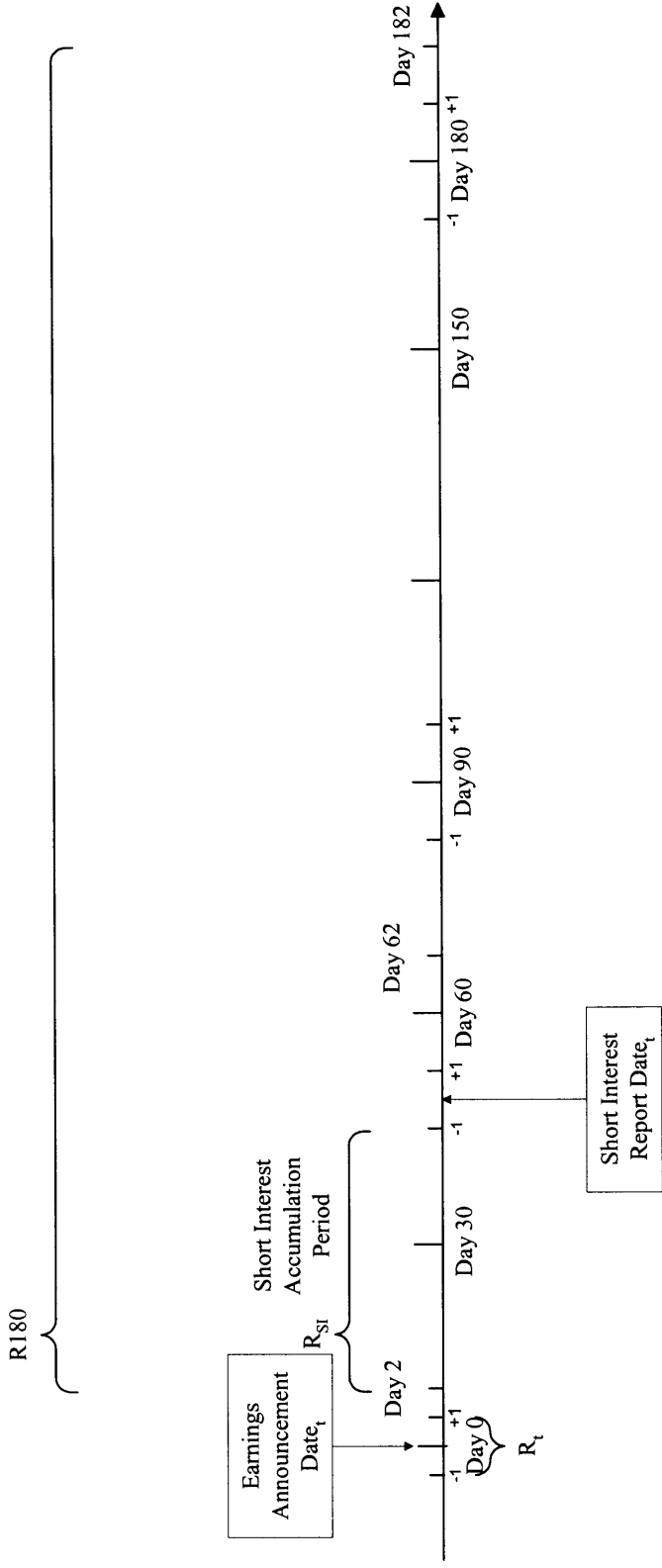


Table 1
Descriptive Statistics

This table provides descriptive statistics for variables used in subsequent tests. To be included in this table, a firm-quarter observation must have sufficient data to compute the below displayed variables. Firm-quarter observations are drawn from the period between 1995 and 2003.

Variable	N	Mean	Std Dev	Minimum	25th Pctl	50th Pctl	75th Pctl	Maximum
sips	39955	0.0223	0.04	0.0000	0.0004	0.0043	0.0228	0.2559
sue	39955	-0.03	1.11	-2.67	-0.72	0.02	0.71	2.66
pmda	39955	0.02	0.11	-0.16	-0.04	0.00	0.04	0.32
mktvalue	39261	658.93	6051.43	0.16	36.81	106.04	334.54	448788.94
bm	39955	0.63	0.63	0.00	0.21	0.44	0.82	3.44
volps	39955	0.0087	0.01	0.0000	0.0015	0.0040	0.0096	0.0913
React	28741	1.49%	0.25	-264.25%	-11.55%	1.01%	14.10%	350.90%
Rsi	39955	1.22%	0.23	-60.12%	-11.15%	0.20%	12.35%	77.85%
R180	39955	-5.96%	0.61	-114.85%	-35.04%	0.09%	28.90%	164.16%

Variable Definitions

sips	Short interest per share: the ratio of the number of shares shorted in the month after quarterly earnings announcement, deflated by the number of shares outstanding at the end of the quarter.
sue	Standardized unexpected earnings: seasonally differenced quarterly earnings divided by the standard deviation of the forecast error.
pmda	Performance-matched discretionary accruals.
mktvalue	Market value of equity, in \$millions, measured at the end of quarter t.
bm	Book-to-market ratio measured at the end of quarter t.
volps	Trading volume: the average daily trading volume as reported on the NASDAQ monthly short interest report deflated by the number of shares outstanding.
React	The sum of the market reactions to earnings announcements in the next three quarters, quarters t+1 to t+3, minus the market reaction to the earnings announcement in quarter t+4. The market reaction in each quarter is defined as the cumulative size-adjusted return over the three trading day window that begins one trading day before the earnings announcement.
Rsi	Cumulative, size-adjusted return over the period beginning 2 days after the earnings announcement and ending 1 day before the first short interest reporting date that comes after the earnings announcement date.
R180	Cumulative, size-adjusted return over the 180-day period beginning 2 days after the earnings announcement in quarter t and ending 182 days after.

Table 2**OLS Regression analysis testing the Short Seller Exploitation Hypothesis (H1)**

$$sips = \alpha + \beta_1 * suedecilerv + \beta_2 * pmdadecile + \beta_3 * suedecilerv * pmdadecile + \beta_4 * Lnmv + \beta_5 * BM + \beta_6 * Volps + \varepsilon$$

This table presents test results for the hypothesis that high short sellers exploit market under-reaction and overreaction to negative earnings surprise and income-increasing accruals, respectively. The table contains time-series means of coefficients and adjusted R²s produced by 34 quarterly cross-sectional OLS regressions using the model shown above. Standard errors are in parentheses and asterisks indicate one-sided statistical significance. There are a total of 39,955 observations in the sample. The time period is from 1995 to 2003. The intercept and coefficients on industry indicators are not reported.

Variable	Predicted Sign	Mean	
suedecilerv	+	0.0004 (0.0002)	***
pmdadecile	+	0.0002 (0.0001)	
suedecilerv*pmdadecile	+	0.0000 (0.0000)	
lnmv	+	0.0054 (0.0003)	***
bm	-	-0.0030 (0.0003)	***
volps	+	1.6455 (0.0850)	***
Adjusted R square		38.56%	

* Indicates statistical significance at the 10% level.

** Indicates statistical significance at the 5% level.

*** Indicates statistical significance at the 1% level.

Variable Definitions

sips	Short interest per share: the ratio of the number of shares shorted in the month after quarterly earnings announcement, deflated by the number of shares outstanding at the end of the quarter.
suedecilerv	Reversed decile rank of sue from 10 to 1, 10 being the lowest sue and 1 being the highest. This is done to ensure the interaction term of sue and pmda have the same directional effect on the dependent variable.
pmdadecile	Decile rank of pmda from 1 to 10, 1 being the lowest and 10 the highest.
lnmv	Log of market value of equity for current quarter.
bm	Book-to-market ratio measured at the end of quarter t.
volps	Trading volume: the average daily trading volume as reported on the NASDAQ monthly short interest report deflated by the number of shares outstanding.

Table 3**Nonlinear regression analysis testing the Short Seller Exploitation Hypothesis (H1)**

$$HighSI = \alpha + \beta_1 * suedecilerv + \beta_2 * pmdadecile + \beta_3 * suedecilerv * pmdadecile + \beta_4 * Lnmv + \beta_5 * BM + \beta_6 * Volps + \varepsilon$$

This table presents test results for the hypothesis that high short sellers exploit market under-reaction and overreaction to negative earnings surprise and income-increasing accruals, respectively. The table contains time-series means of coefficients produced by 34 quarterly cross-sectional logistic regressions using the model shown above. Standard errors are in parentheses and asterisks indicate one-sided statistical significance. There are a total of 39,955 observations in the sample. The time period is from 1995 to 2003. The intercept and coefficients on industry indicators are not reported.

Independent Variables	Predicted Sign	Mean
suedecilerv	+	0.0595 ** (0.0238)
pmdadecile	+	0.0426 ** (0.0185)
suedecilerv*pmdadecile	+	-0.0036 (0.0035)
lnmv	+	0.3057 *** (0.0321)
bm	-	-1.8870 *** (0.1618)
volps	+	57.1810 *** (2.9433)

* Indicates statistical significance at the 10% level.

** Indicates statistical significance at the 5% level.

*** Indicates statistical significance at the 1% level.

Variable Definitions

highsi	High short interest dummy variable which equals 1 if short interest per share is above 95 percent of the sample distribution and zero otherwise.
suedecilerv	Reversed decile rank of sue from 10 to 1, 10 being the lowest sue and 1 being the highest. This is done to ensure the interaction term of sue and pmda have the same directional effect on the dependent variable.
pmdadecile	Decile rank of pmda from 1 to 10, 1 being the lowest and 10 the highest.
lnmv	Log of market value of equity for current quarter.
bm	Book-to-market ratio measured at the end of quarter t.
volps	Trading volume: the average daily trading volume as reported on the NASDAQ monthly short interest report deflated by the number of shares outstanding.

Table 4

Regression analysis testing the Anticipation Enhancement Hypothesis (H2)

$$REACT = \alpha + \beta_1 sips + \beta_2 Suedecilerv + \beta_3 Pmdadecile + \beta_4 sips * Suedecilerv + \beta_5 sips * Pmdadecile + controls + \varepsilon$$

This table presents test results for the hypothesis that high short interest enhances the extent to which the market anticipates future earnings. The table contains time-series means of coefficients and adjusted R²s produced by 34 quarterly cross-sectional OLS regressions using the model shown above. Standard errors are in parentheses and asterisks indicate statistical significance, which is one-sided where I have a prior for a coefficient's sign and two-sided otherwise. There are a total of 39,955 observations in the sample. The time period is from 1995 to 2003. The intercept and coefficients on industry indicators are not reported.

Dependent Variable: REACT					
Independent Variables	Predicted Sign	1	2	3	4
sips	-	-0.1450 (0.1274)	0.5577 (0.6642)	3.8636 (3.8909)	4.2715 (4.3598)
suedecilerv	-	-0.0025 *** (0.0007)	-0.0026 *** (0.0007)	-0.0027 *** (0.0008)	-0.0028 *** (0.0008)
pmdadecile	-	-0.0005 (0.0008)	-0.0005 (0.0008)	-0.0002 (0.0010)	-0.0002 (0.0010)
sips*suedecilerv	+		-0.0983 (0.1116)		-0.0625 (0.0747)
sips*pmdadecile	+			-0.4484 (0.4471)	-0.4436 (0.4420)
lmrv	?	-0.0077 *** (0.0024)	-0.0077 ** (0.0024)	-0.0079 *** (0.0022)	-0.0079 *** (0.0022)
bm	?	0.0167 ** (0.0070)	0.0166 ** (0.0068)	0.0180 ** (0.0078)	0.0180 ** (0.0077)
volps	?	0.5717 * (0.2966)	0.5732 * (0.3114)	0.4620 (0.3968)	0.4653 (0.4068)
Adjusted R square		0.62%	0.35%	0.54%	0.23%

* Indicates statistical significance at the 10% level.
 ** Indicates statistical significance at the 5% level.
 *** Indicates statistical significance at the 1% level.
 For variable definitions, see Table 1 and Table 2.

Table 5
Regression analysis testing the Price Decline Expediting Hypothesis (H3)

$$R_{st} = \alpha + \beta_1 sips + \beta_2 suedecile + \beta_3 pmdadecile + \beta_4 R180 + controls + \varepsilon$$

This table presents test results for the hypothesis that high short interest expedites the long-run (180 day) price decline that follows a negative earnings surprise and income increasing accruals. Specifically, I test whether more of the long-run price decline, as measured by R180, gets realized during the short interest accumulation period when short interest, sips, is reported to be high at the end of the accumulation period. The table contains time-series means of coefficients and adjusted R²s produced by 34 quarterly cross-sectional OLS regressions using the model shown above. Standard errors are in parentheses and asterisks indicate statistical significance, which is one-sided where I have a prior for a coefficient's sign and two-sided otherwise. There are a total of 39,955 observations in the sample. The time period is from 1995 to 2003. The intercept and coefficients on industry indicators are not reported.

Independent Variables	Predicted Sign	1	2	3	4	5
sips	-	-0.0524 (0.2254)	-0.2095 *** (0.0611)	-0.2179 *** (0.0566)	-0.2060 *** (0.0622)	-0.2176 *** (0.0556)
suedrv	-	-0.0013 *** (0.0005)		0.0003 (0.0005)		0.0003 (0.0005)
pmdadecile	-	-0.0002 (0.0007)			-0.0003 (0.0007)	-0.0003 (0.0007)
R180	+		0.1472 *** (0.0087)	0.1474 *** (0.0087)	0.1472 *** (0.0087)	0.1474 *** (0.0087)
lnmv	?	-0.0115 *** (0.0018)	-0.0046 *** (0.0017)	-0.0046 *** (0.0017)	-0.0046 *** (0.0016)	-0.0046 *** (0.0017)
bm	?	0.0270 *** (0.0049)	0.0197 *** (0.0047)	0.0194 *** (0.0047)	0.0197 *** (0.0045)	0.0192 *** (0.0045)
volps	?	2.7187 *** (0.4740)	2.3573 *** (0.3162)	2.3523 *** (0.3163)	2.3463 *** (0.3189)	2.3339 *** (0.3214)
Adjusted R square		5.06%	17.48%	17.45%	17.55%	17.51%

* Indicates statistical significance at the 10% level.

** Indicates statistical significance at the 5% level.

*** Indicates statistical significance at the 1% level.

For variable definitions, see Table 1 and Table 2.