Bears and Numbers:
How short sellers exploit and affect mispricing of earnings information

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Abstract

Using a unique dataset of shares available for borrowing as of the earnings announcement date, we document that short selling plays an important role in the pricing of accruals and earnings surprise. First, we find that short sellers exploit post–earnings–announcement drift and the accrual anomaly. In addition, we find the negative abnormal returns that normally follow an extreme negative earnings surprise or extreme positive accrual disclosure, respectively, disappear when at least 14.5% and 6.2% of shares are available for short sellers to borrow. Furthermore, we demonstrate that this effect is distinct from that of institutional holdings, which can affect pricing of accruals and earnings surprise in ways unrelated to short selling.

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Asset pricing theory asserts that arbitrageurs play a central role in keeping prices near fair value (e.g. Shleifer.and Summers (1990)). In contrast to profiting from undervaluation, profiting from overvaluation presents a special challenge to arbitrageurs: it requires them to sell short, a transaction which at times can be difficult or impossible to execute (e.g. D'Avolio (2002)). In this study we demonstrate that short sellers, or bears, respond to signals of overvaluation. Furthermore, using a novel database that directly identifies shares available for short selling, we demonstrate that constraints on bears significantly affect stock prices.

Public disclosures of earnings data are associated with some of the most persistent and well-documented pricing anomalies (e.g. Fama (1998)). Specifically, a vast literature documents that stock prices persistently underreact to extreme earnings shocks, and fail to correctly incorporate the information contained in the accrual component of earnings.[1] This study is the first to document that short sellers exploit underreaction to negative earnings shocks. We also find that accruals and earnings shocks have interactive effects on short interest, which previous studies on the link between short interest and accruals have ignored (e.g. Hirshleifer, Teoh and Yu (2006), Richardson (2003), Zhang and Cready (2004)). Specifically, we find that short sellers react more strongly to accruals when earnings beat expectations by a greater amount. Short sellers also respond less strongly to negative earnings shocks when accruals are negative. Furthermore, we show the long-run negative abnormal returns normally following high accruals or a negative earnings surprise to be significantly attenuated when there are a high number of shares

[1] Ball and Brown (1968) were the first to document that stocks underreact to earnings announcements. Foster, Olsen and Shevlin (1984) and Bernard and Thomas (1989 and 1990) provide further evidence. Sloan (1996) first documented the mispricing of accruals. See Kothari (2001) for a comprehensive review of both literatures.

available for short sellers to borrow. Hence we provide direct evidence that short sale constraints play an important role in mispricing. Finally, we demonstrate that institutional holdings affect pricing in ways unrelated to short selling, suggesting the use of institutional holdings as a proxy for short sale constraints, although common in the literature, is problematic.

While other studies attempt to examine the relation between stock prices and proxies for short sale constraints, our results provide more definitive evidence that short sale constraints play an important role in the mispricing of public information. Asquith, Patak and Ritter (2005) and Nagel (2005) find that stocks with high levels of institutional ownership are less likely to be overpriced. Chen, Hong and Stein (2002) find that stocks more broadly held by mutual funds are less likely to be overpriced. All the above studies assume that institutional ownership and/or breadth of mutual fund holdings are valid proxies for short sale constraints, so they interpret their results as evidence that short sale constraints increase mispricing. The finds of Ayers and Freeman (2003) and Ke and Ramalingegowda (2005), however, cast doubt on the validity of this interpretation. They find institutions respond more rationally to news than retail investors, and that institutional trading causes information to get incorporated into stock prices more quickly. Hence it is possible the results of Asquith et al., Nagel, and Chen et al. are due to institutional trading and are unrelated to short sale constraints. In fact, Chen et al. acknowledge that mutual fund stock picking ability might be driving their results. In contrast, we employ a direct measure of short sale constraints, the number of shares available for borrowing, while simultaneously controlling for institutional holdings, liquidity, and other factors. Hence our results are more definitive.

Other studies, including Jones and Lamont (2002), Ofek, Richardson and Whitelaw (2004), and Reed (2007), find that low rebate rates, which make short selling expensive, forecast abnormal returns. Since we use abnormal returns as a measure of mispricing, we cannot use rebate rates as an exogenous measure of short sale constraints. Instead, we use a measure of share loan supply. Cohen, Diether, and Malloy (2007) find that while changes in share borrowing demand forecast future abnormal returns, changes to lending supply do not. Hence by using our measure of supply, we can draw cleaner inferences about the pricing effects of short sale constraints.

By focusing on short interest after earnings announcements, this paper sheds light on how short sellers use public, rather than private, information. Numerous studies, including Asquith, Pathak, and Ritter (2005), Asquith and Muelbrook (1996) and Desai, Ramesh, Thiagarajan and Balachandran (2002) find that high levels of short interest forecast negative abnormal returns. While these findings suggest that short sellers can anticipate negative abnormal returns, they provide little indication as to whether short sellers are exploiting mispricing of public information or merely trading on private information.

Christophe, Ferri and Angel (2004), who find short interest is higher prior to the announcement of a negative earnings shock, confirm that private information drives a considerable amount of short selling. Desai, Krishnamurthy and Venkataraman (2006a) draw similar inferences from finding that short interest is higher around earnings restatements. In a related study, Karpoff and Lou (2006) find increases in short interest before the announcement of fraud investigations. In contrast, by documenting a relation between public signals of overvaluation and short interest *after* the public release of financial statements, we demonstrate how short sellers also exploit the mispricing of *public* information.

Dechow, Hutton, Meulbroek, and Sloan (2001) document a strong negative relation between short interest and ratios of fundamentals to prices, suggesting that short-sellers target overvalued companies. As the authors acknowledge, it is possible that book-to-market ratios and others like them reflect risk factors rather than mispricing, making it unclear whether short-sellers who trade based on such ratios are actually exploiting pricing anomalies. In contrast, our study examines whether short sellers exploit and affect uncontroversial examples of mispricing: earnings surprise and accruals.

The remainder of the paper proceeds as follows. Section 1 details our hypotheses and their empirical implications. Section 2 outlines the sample selection procedure, defines the variables, and describes the data. Section 3 discusses the tests and presents empirical results, concluding with final thoughts in Section 4. \

1. Hypothesis Development

This section is divided in two. The first subsection (1.1) discusses the interaction between post-earnings announcement drift (PEAD) and accrual anomalies, which leads to our first main hypothesis, which is on the relation between short interest and earnings information (H1). Also in the first subsection, we discuss two secondary hypotheses on the interactive effects of PEAD and accruals on short interest (H1a and H1b). In the second subsection (1.2), we discuss our second main hypothesis, which is on short interest and price convergence (H2).

1.1 Shorting to Exploit Earnings-Based Anomalies

> *"…Messrs. Jacobs and Levy repeatedly scour 3,000 stocks looking for clues to each issue's future direction …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."*
> - James White, *The Wall Street Journal*, March 20, 1991

A good deal of accounting and finance literature documents that negative shocks to earnings forecast negative abnormal returns (e.g. Kothari (2001)). This phenomenon is commonly referred to as "post-earnings announcement drift," or the "PEAD" anomaly. Similarly, beginning with Sloan in1996, numerous studies have documented the market appears to overprice income-increasing discretionary accruals. Stocks with high discretionary accruals often experience negative abnormal returns for a period of time following the release of a firm's financial statements. If short sellers are sophisticated investors who benefit from price declines (e.g. Dechow, Hutton, Meulbroek and Sloan (2001) and Desai, Ramesh, Thiagarajan and Balachandran (2002)), we expect them to take advantage of the predictable extreme negative returns of stocks with positive accruals and negative earnings surprise. This then leads us to form our first main hypothesis, the *Short Seller Exploitation Hypothesis*, or H1, as follows:

H1: Negative earnings surprises and income-increasing accruals lead to high short interest.

It is important to recognize that PEAD and the accrual anomaly are closely related. Analyzing one without the other may result in biased estimates and low statistical power. The level of accruals embedded in earnings surprises can mitigate or exacerbate the amount of drift that follows an earnings surprise (e.g. Collins and Hribar

(2000)). Both variables are considered in our tests, thereby increasing statistical power and avoiding omitted variable bias.

In addition, accruals and earnings surprises may have interactive effects. If a negative earnings surprise is the result of an earnings bath generated by extremely negative accruals, it may not be a good predictor of subsequent negative returns, and likely will not trigger much short selling. The expectation then, is that negative earnings surprise accompanied by large negative accruals will result in less short selling than would a negative earnings surprise with a small accrual component. This is our secondary hypothesis, H1a:

H1a: A negative earnings surprise accompanied with extreme income-decreasing accruals will have a lesser effect on short interest than would a negative earnings surprise without significant negative accruals.

On the other hand, it is plausible that high discretionary accruals used to artificially generate a positive earnings surprise might create more overpricing than accruals in other contexts. Given that scenario, the effect of high accruals on short interest is likely enhanced in the presence of high unexpected earnings. This leads us to an additional secondary hypothesis, H1b:

H1b: High income-increasing accruals should have a greater effect on short interest provided they result in higher unexpected earnings.

1.2 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.

We hypothesize that short selling facilitates the movement of prices to the level that correctly reflects income-increasing accruals and negative earnings surprise.

According to the efficient market hypothesis, rational speculative activity, including short selling, should eliminate mispricing (e.g. Fama (1965)). There is voluminous literature on the effects of different market participants on pricing anomalies, whether they are institutions, analysts, or insiders.[2] If shorting moves overpriced high accrual and negative earnings surprise stocks to their fundamental value, immediately following a period short selling, the prices of heavily-shorted stocks should be closer to fundamentals.

Analysis of long-run abnormal returns is a standard way to measure the extent to which a stock is close to fundamental value. At first glance, the most obvious research design would be to compare the post-shorting abnormal returns of stocks that experienced high short selling to stocks that did not, holding constant the level of accruals and earnings surprise.

This research design, however, has a serious drawback: not all speculative short selling is related to PEAD or the accrual anomaly. If short sellers, in addition to exploiting these two anomalies, are also anticipating other unrelated price declines, then the effect of short selling on post-shorting long-run returns becomes ambiguous. By facilitating efficient pricing of accruals and earnings surprises, high short selling might be

[2] For example, see. Bartov, Radhakrishnan, and Krinsky 2000, Collins, Gong, and Hribar, 2003, Ke and Ramalingegowda, 2005, Barth and Hutton, 2004, Ayers and Freeman, 2003, Kolasinski and Li, 2007, and Jenter 2005

associated with less negative post-shorting long-run returns. However, if some short sellers are anticipating other, unrelated price declines, high short selling may also be associated with more negative long-run returns, confounding our inferences on the effect of short selling on pricing efficiency. A better research approach is to examine the effect of some exogenous, ex-ante measure of the ease of shorting. If this measure of the ease of shorting is not related to future returns through channels other than more efficient pricing through short selling, it will give clean inferences of the pricing effects of shorting. We believe the ex-ante number of shares available for borrowing by short sellers meets this criterion. This brings us to our second main hypothesis, referred to as the *Overpricing Reduction Hypothesis*, or H2:

H2: Among stocks with negative earnings surprise and high accruals, the long-run returns following a period of short selling after the release of financial statements should be less negative when there are more shares available for borrowing by short sellers prior to the earnings announcement.

2. Data

2.1 Data Sources and Sample Selection

Our sample for testing the short seller exploitation hypothesis (H1) contains NASDAQ firms active during 1995 – 2006, the period for which short interest data are available from NASDQ. Our sample for the Overpricing Reduction Hypothesis (H2) contains NASDAQ firms' active forms from Oct 2004 – June 2006, the period for which we have data on shares available for borrowing. For each sample firm, we require data from Compustat to compute accruals, earnings surprise, and the book-to-market ratio. From the Center for Research on Securities Prices (CRSP) we require data needed to compute post-earnings announcement stock returns, as well as pre-announcement market capitalization, volatility, turnover, and the Amihud (2002) illiquidity measure. We also require additional data from CDA-Spectrum, OptionMetrics, and I/B/E/S on institutional holdings, listed options, and analyst following. We include in our sample only firms with a December fiscal year end to ensure uniformity of seasonal effects, which Foster (1977) finds to be important. In addition, we exclude financial firms because their accruals have a different economic meaning than that of non-financial firms.

Desai, Krishnamurthy, and Venkataraman (2006b) show that a large portion of short selling activity is driven by index and convertible arbitrage. To segregate the short selling driven by PEAD and accrual strategies from that driven by index and convertible strategies, we exclude from our sample stocks that either belong to the S&P 500 index or have convertible bonds. Our results still hold if we include these stocks and use convertible and index dummies as controls, but statistical power is reduced.

We obtain data on short interest from NASDAQ. NASDAQ defines short interest as the total number of short positions as of a given date, and has made this data publicly available on a monthly basis since October 1995. Hence, for each firm-quarter observation, we obtain short interest normalized by shares outstanding, or *sips*, from NASDAQ as of the first settlement date that occurs after the SEC deadline for filing financial statements[3].

[3] We focus on the level of short interest to ensure that we include in our analysis those bears who exploit PEAD and accrual overpricing by continuing to hold short positions established prior to the announcement. As a robustness check, we also analyze the effect of changes and find similar results.

We calculate earnings surprise, or standardized unexpected earnings (sue), in the same manner as Bernard and Thomas (1989 & 1990). This procedure requires firms to have at least ten quarters of data on earnings exclusive of extraordinary items and discontinued operations. We need ten consecutive quarters, from t-10 to t-1 (the estimation period), to estimate the drift parameter of a seasonal random-walk-with-drift model for earnings. We then use this earnings model to estimate standardized unexpected earnings, or earnings surprise, for quarter t (the event quarter). Because a large number of firms do not have analyst coverage, we do not use analyst forecasts to compute earnings expectations. Finally, since negative and positive earnings surprise might have an asymmetric effect on short interest, we define two variables, $surprise^+$ and $surprise^-$, which are equal to the absolute value of surprise when it is positive and negative, respectively, and zero otherwise.

We compute performance-matched discretionary accruals in the same manner as Louis (2004). We use performance matched discretionary accruals, henceforth simply "accruals," in order to have an unbiased measure of earnings management (e.g. Kothari, Leone and Wasley (2004)). This procedure requires each firm-quarter observation to have data on earnings report dates, total assets, current assets, cash, sales, accounts receivable and current liabilities. We also require at least ten industry peer firms in a given quarter, with industry defined by 2-digit SIC codes, in order to conduct the performance adjustment. Finally, since negative and positive accruals might have an asymmetric effect on short interest, we define two variables, $accruals^+$ and $accruals^-$, which are equal to the absolute value of accruals when they are positive and negative, respectively, and zero otherwise.

Using CRSP, we compute the buy-and-hold return beginning one week after the 10Q or 10K filing deadline and ending 180 days after the earnings announcement. We begin the return horizon one week after the filing deadline because some firms file late, and we subtract the buy-and-hold return of each firm's corresponding size decile portfolio to obtain an abnormal return, Rpostdisc.

The above requirements reduce our sample to 39,955 firm-quarter observations covering 2,476 distinct firms.

Finally, we compute the following control variables:

- We calculate the Amihud (2002) illiquidity measure using price and volume data from CRSP from 90 to 60 days before the announcement.
- I/B/E/S provides analyst data on the number of analysts covering the firm; if a firm is not in I/B/E/S, we keep it in our sample and assume it has no analyst coverage.
- Compustat provides quarter-end stock prices, shares outstanding, and book value of common equity needed to calculate market capitalization and the book-to-market ratio.
- CDA Spectrum provides data on institutional holdings, which we define as total number of shares held by institutions divided by total shares outstanding.
- Data provided by OptionMetrics allows us to determine whether a stock had listed options as of an earnings announcement. If a stock is not in this database, we keep it in the sample, noting it has no listed options.

We require each firm quarter observation to have all of the above control variables. After all criteria are applied, our sample comes to 32,518 firm-quarter observations.

A leading securities lending firm provides us data describing the number of shares available for loan. The data come from a saved daily report of shares available from custodian banks, brokers and other firms willing to lend shares. In our tests, the shares available are deflated by the total number of shares outstanding. The availability is an indication of the number of shares that can be borrowed by short sellers as of the beginning of each trading day from October 4th 2004 – February 14th, 2007. The availability database is incomplete: it does not provide information from all possible lenders, and reporting lenders have discretion over how much availability to report. Nevertheless, the availability database covers many stocks in the CRSP universe. On average, the database has availability information for 78% of the CRSP stocks each month, and 6,285 unique CRSP stocks at least once during the period. Furthermore, there are a sizeable number of shares available for loan from the reporting lenders; the average number of shares available for loan is 6% of the number of shares outstanding.

We use availability of shares for borrowing as our measure of ease of short selling for two main reasons. First, Cohen, Diether and Malloy (2007) find that changes in share borrowing demand affect future abnormal returns significantly, whereas changes to lending supply have no significant effect. A lending supply measure, such as shares available for borrowing, is therefore not directly related to future returns, allowing us to use it as an exogenous measure of short sale constraints in regressions with returns as the dependent variable. More traditionally used proxies for short sale constraints, for example, direct measures of borrowing costs, reflect both supply and demand factors.

Cohen, et al. find that changes in borrowing demand affect returns in ways likely unrelated to PEAD and accruals pricing, Therefore using borrowing costs could confound our results due to the endogeneity problem. Indeed, we find that our measure of shares available for borrowing is unrelated to future returns, unlike various measures of borrowing cost, such as abnormal lending fees, that are.[4]

Secondly, the supply of shares available is a less noisy measure of short sale constraints than other measures, for example, abnormal lending fees. Since availability is primarily driven by changes in institutional and retail margin account ownership, shares available for borrowing are immune to the demand-driven episodic changes in abnormal lending fees as described in Geczy, Musto and Reed (2002). Support for this assertion is evident in our data: within-firm time series volatility is significantly higher for lending fees than for share availability. Specifically, the annual coefficient of variation is 4.66% higher for the abnormal lending fee than for share availability in NASDQ stocks from 2004 to 2006.

2.2 Descriptive Statistics

In Figure 1, we plot the equally-weighted mean short interest per share on a quarterly basis over the interval 1995 – 2006 for all NASDAQ companies. Note that aggregate short interest per share declines substantially as the dotcom bubble expands upward from mid-1998 to its peak in early 2000. It then rebounds sharply as the bubble

[4] We use the average of daily shares available for loan over the period from 30 to 90 days before the earnings announcement. When we regress future abnormal returns on this variable and various controls, the coefficient on shares available is not statistically significant. The results of this regression, labeled Model R1, are in Table 4. We also produce a regression identical to Model R1 in all respects, except we replace the shares available variable with the average daily abnormal lending fee computed over the same period. The results, available upon request, show a statistically significant and negative coefficient on the lending fee. We thus infer that lending fees are unconditionally related to future returns, whereas shares available for loan are not.

explodes over the subsequent two years. 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 our sample period, and never exceeds 6 percent of shares outstanding.

Figure 2 illustrates the histogram of short interest per share 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% shares outstanding, 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. We run non-linear as well as linear specifications for our tests to ensure that the skewness of the distribution is not biasing our results.

Table 1 provides descriptive statistics for the final sample. We winsorize all the variables at 1% and 99% level, except for the *lnmv* (size) variable, for which we use the log value in the regression.

Some of the variables appear to have irregular distributions. The mean short interest per share is 2.4 percent, and the median is 0.6 percent, indicating a highly skewed distribution. As shown in figure 2, a few firms have very high short interest. Thus, in addition to OLS analysis to test H1, we use a logistic specification with a dummy indicating extreme values of short interest as a dependent variable. The market value variable is also skewed to the right. This asymmetry of raw market value is due to the presence of a small number of large firms. The log of market value, however, is approximately symmetric, so we use the log transformation in our tests.

The distributions of other variables appear better-behaved. The mean of standardized unexpected earnings (*surprise*) is -0.043and the median is -0.015 — quite close to one another and close to zero compared to a standard deviation of 1.06. The same is the true for performance-adjusted discretionary accruals (*accruals*), which have a mean of -0.006 and a median of -0.002. Institutional holdings, analyst coverage, the return variables, as well as the book-to-market ratio all appear to have well-behaved distributions.

3 Tests and Results

3.1 Short Interest and Earnings-Based Anomalies

H1 predicts high short interest would likely result from negative earnings surprises and income-increasing accruals. We test H1 by regressing short interest on surprise and accruals and specify the regression as follows:

$$sips = \alpha + \beta_1 surprise^{+} + \beta_2 surprise^{-} + \beta_3 accruals^{+} + \beta_4 accruals^{-} + Controls + \varepsilon \qquad \text{(Model 1)}$$

Where the dependent variable, s*ip*s, is the short interest per share. *Controls* is a vector that includes all of the following control variables.

oplist	=	Dummy indicating that option contracts on the stock are listed
insthld	=	Proportion of shares held by institutions in quarter t
nanalysts	=	Number of analysts covering the firm at the end of quarter t
lnmv	=	Natural log of market value of equity at the end of quarter t;
bm	=	Book-to-market ratio measured at the end of quarter t;

turn	=	Turnover per share: the average daily trading volume in the 30 days prior to the earnings announcement divided by total shares outstanding.
illiquidity	=	The Amihud (2002) illiquidity measure.
arbrisk	=	The Mshruwala, Rajopal and Shevlin (2006) proxy for arbitrage risk: a stock's idiosyncratic volatility of monthly returns over the previous four years.

H1 predicts positive coefficients on *surprise*$^{-}$ and *accruals*$^{+}$ since it postulates that low unexpected earnings and high accruals are associated with increased short selling. In all regressions testing H1, we use seven control variables: oplist, insthld, nanalysts, lnmv, bm, turn, and illiquidity, as discussed in section 2.2.5.

We estimate Model 1 for the panel of data. Using a method suggested in Cameron, Gelbach and Miller (2006), we cluster standard errors by both calendar quarter and firm, thereby ensuring they are robust to heteroskedasticity, as well as serial- and cross-sectional correlation in the error terms. We compute our standard errors this way in all our regressions. To control for unobserved market-wide shocks, we include calendar quarter fixed effects. Table 2, column 1 reports the results. Confirming hypothesis H1, we find positive coefficients on *surprise*$^{-}$ and *accruals*$^{+}$ that are statistically significant at the 5% level or better. Hence we find that short sellers trade in response to negative earnings shocks and positive accruals. The coefficient estimates are also economically significant. A negative one-standard deviation earnings surprise will increase short interest by 0.2% of shares outstanding, which is large compared 0.6%, the median value of short interest per share. Increasing discretionary accruals from zero by one standard deviation, implying an increase from 0 to 0.15, tends to increase short interest by 0.135% of shares outstanding.

To get a sense of how accruals and earnings surprises may interact in determining short interest, we estimate the following regressions:

$$sips = \alpha + \beta_1 surprise^{+} + \beta_2 surprise^{-} + \beta_3 accruals^{+} + \beta_4 accruals^{-} + \beta_5 accruals^{+} * surprise^{+} + Controls + \varepsilon \qquad \text{(Model 2)}$$

$$sips = \alpha + \beta_1 surprise^{+} + \beta_2 surprise^{-} + \beta_3 accruals^{+} + \beta_4 accruals^{-} + \beta_5 accruals^{-} * surprise^{-} + Controls + \varepsilon \qquad \text{(Model 3)}$$

$$sips = \alpha + \beta_1 surprise^{+} + \beta_2 surprise^{-} + \beta_3 accruals^{+} + \beta_4 accruals^{-} + \beta_5 accruals^{+} * surprise^{-} + Controls + \varepsilon \qquad \text{(Model 4)}$$

The results are in columns 2 - 4 of Table 2. Notice that in Model 2, coefficient on $accruals^{+} * surprise^{+}$ is positive and significant at 5%, whereas the coefficient on the $accruals^{+}$ is insignificant. Thus, short interest is sensitive to high accruals only when they coincide with higher, positive unexpected earnings. We interpret this as evidence that speculators short sell more when firms are managing earnings to achieve a larger degree of positive earnings surprise, supporting H1b. The interaction terms in the other models, however, are not statistically significant.

In checking for robustness, we estimate a model identical to model 1, altering it by using the seasonal differences of sips, accruals, surprise, and the control variables in the specification. That is, we compute the difference between the current value of a variable and the value during that same quarter, the previous year. We use seasonal differences, rather than simple first differences, because our independent variables are based on quarterly financial statement data, which are well-known to have seasonal attributes (e.g. Foster (1977)). Our findings indicate both the seasonal change in unexpected earnings and accruals have a significant effect on the seasonal change in short interest at the 5% and 10% levels, respectively.

Since the distribution of short interest is highly skewed, the relation between earnings variables and short interest is likely non-linear. Thus, following Asquith, Patak and Ritter (2005), we employ a logistic regression analysis to test H1. We define a dummy variable *highsi*, which equals 1 if short interest per share for a particular firm-quarter observation falls above the 90th percentile within the time series for the firm and zero otherwise. Using *highsi* as the dependent variable, we then estimate a logistic model. We use the same independent variables used in OLS models 1-3. H1 makes the same predictions for the logistic parameter estimates as it does for those of the OLS analysis.

Table 3 reports the results for logistic models L1-L4. The effect of negative earnings surprises on short interest is robust to the logistic specification. In all logistic models the effect is both statistically and economically significant. In model L1, the coefficient estimate on $surprise^{-}$ is 0.15 — a value that implies an odds ratio of 1.17, meaning a one standard deviation negative surprise increases the odds of short interest reaching extreme levels by a factor of 1.17.

The coefficient on positive accruals, however, does not appear to unconditionally drive short interest to extreme levels. Accruals, however, still matter, as indicated in Model L3. The negative coefficient on the interaction between $surprise^{-}$ and $accruals^{-}$ indicates that short sellers are less likely to react to a negative earnings surprise when earnings contain negative accruals, consistent with hypothesis H1a.

3.2 Shorting and Pricing

In this section, we test the Overpricing Reduction Hypothesis (H2), which postulates stocks with low earnings and high accruals will be more fairly priced after the earnings announcement provided there are more shares available to borrow by short sellers. This implies bad earnings news and high accrual stocks with more available shares for borrowing will have less negative long-run abnormal returns following the release of financial statements. To test H2 in the context of earnings surprise, we run the following regression:

$$Rpostdisc = \alpha + \beta_1 available * surprise^- + \beta_2 surprise^- + \beta_3 available + \beta_4 surprise^+ + \beta_5 accruals^+ + \beta_6 accruals^- + Controls2 + \varepsilon \qquad (Model\ 6)$$

Where *Rpostdisc* is the post-disclosure abnormal return, that is, the size-adjusted buy-and-hold return over the period that begins one week after the 10K or 10Q filing deadline, and ends 180 days after the earnings announcement. The variable *available* equals the average daily number of shares available for borrowing from 30 to 90 days before the earnings announcement. The vector *Controls2* includes the amihud illiquidity measure (*illiquidity*), our proxy for arbitrage risk (*arbrisk*), the book-to-market ratio (*bm*) and the log of market capitalization (*lnmv*). The results of the regression are in Table 4, Panel A. Statistical inferences are made using standard errors clustered by firm and calendar quarter, thereby making them robust to heteroskedasticity as well as cross-sectional and serial error correlation. To test H2, we focus on the coefficient on the interaction term, finding it is positive and highly statistically significant, having a p-value of less than 0.01. This implies that having more shares available for short sellers to borrow significantly attenuates the negative abnormal returns that normally follow a negative earnings surprise.

One possible concern is that stocks with low availability have larger reactions to news in the long run, so we must also explore longer-horizon returns. To address this concern, we use returns that end 365 days after the announcement and the results (untabulated) are similar.

It is also plausible that the above result is driven by some correlated omitted variable. One likely candidate is liquidity. Shares with greater liquidity might be more likely to be held by investors with margin accounts, which in turn are more likely to be made available for borrowing. At the same time, greater liquidity might improve the pricing of accruals for reasons unrelated to short selling.

To test whether liquidity is driving our results, we use the Amihud (2002) illiquidity measure (*illiquidity*) and interact it with $surprise^{-}$. We then run a modified version of Model 6, which includes this interaction term. The new regression is called "Model 7", and it can be found in Panel 8, Table 4, Panel A.

Not surprisingly, the coefficient on the interaction between $surprise^{-}$ and *illiquidity* is negative, implying the more illiquid the stock, the more severe the underreaction to negative earnings surprises. However, the interaction between $surprise^{-}$ and *available* continues to be positive and significant in this specification, revealing that liquidity is not driving our result. Model 8, in Panel A of Table 4, also demonstrates the effect of shares available on the pricing of earnings surprise is robust to controlling for the effect of arbitrage risk

Since institutions often lend their shares, institutional holdings are correlated with share availability. In our sample we confirm the correlation is approximately 69%. Thus it is possible that the results in Model 6 are driven by institutional holdings, which might improve pricing of earnings surprises for reasons unrelated to short selling. For example, institutional investors may be less prone to behavioral biases. To rule out this alternative hypothesis, we run regression specification Model 9, again using Model 6, but including the interaction between institutional holdings and *surprise*⁻. The results are in the last column of Table 4, Panel A.

The coefficient on the interaction between shares available and negative earnings surprise continues to be positive. The statistical significance of our estimate is now lower in this specification, taking a p-value of 0.086 instead of 0.01, but it is still marginally significant nonetheless. In contrast, the interaction of institutional holdings and earnings surprise is not statistically significant. Since institutional holdings and shares available are highly correlated, the standard errors of the interaction terms are inflated, and the statistical significance understated. That the coefficient on *available*surprise*⁻ remains marginally significant with the inclusion of the *insthld*surprise*⁻ thus provides strong evidence that share loan availability has an effect on pricing distinct from that of institutional holdings.

Because it is difficult to gage the economic significance on coefficients with interactions between continuous variables, we run the following specification:

$$Rpostdisc = \alpha + \beta_1 available{*}\ badsurprise + \beta_2\ badsurprise + \beta_1 available + \beta_3 goodsurprise + \beta_3 highaccruals^{+} + \beta_4 lowaccruals^{-} + \mathbf{Controls2} + \varepsilon \qquad (Model\ 14)$$

Badsurprise and *goodsurprsie* are dummy variables that take on a value of 1 when earnings surprise is, respectively, in the lowest and highest quintile for a given calendar quarter, and zero otherwise. The dummies *highaccruals* and *lowaccruals* take on a value of 1 when accruals are, respectively, in the lowest and highest quintile for a given calendar quarter, and zero otherwise. The coefficient on *badsurprise* is a negative 4.1%, indicating that stocks with a bad earnings surprise underperform their size group by 4.1% when there are zero shares available for short sellers to borrow. Our estimate of 0.281 for the coefficient on the interaction term implies that stocks will not underperform following a bad earnings surprise if they have at least 14.6% of their shares available for short sellers to borrow.

Next, we test if having more shares available for borrowing improves the pricing of accruals by running the following specification:

$$Rpostdisc = \alpha + \beta_1 available * accruals^{+} + \beta_2 accruals^{+} + \beta_1 available + \beta_3 accruals^{-} + \beta_3 surprise^{+} + \beta_4\, surprise^{-} + \mathbf{Controls2} + \varepsilon \qquad (Model\ 10)$$

The results are in Panel B of Table 4. As expected, the coefficient on $available*accruals^{+}$ is positive and statistically significant at the 5% level, indicating a large number of shares available for borrowing significantly attenuates the negative abnormal returns associated with positive accruals.

As with earnings surprise, we also check in Models 11 and 12 if this result is robust to the inclusion of interactions of accruals and illiquidity and arbitrage risk, finding that it is. As with earnings surprise, we run a specification (Model 15) in which we interact shares available with a dummy for high accruals instead of the continuous variable. The result is in Panel C of Table 4.

The coefficient on *highaccruals* is equal to a negative 0.036, indicating that when there are zero shares available for short sellers to borrow, high accrual stocks underperform their size group by 3.6%. The coefficient on *available*highaccruals* takes the value of 0.579, indicating that high accrual stocks no longer underperform when at least 6.2% of shares are available for short sellers to borrow.

Finally, we run specification Model 13, which is identical to Model 10, with the additional inclusion of the interaction of institutional holdings and *accruals*$^+$. As with Model 9, the high correlation between institutional holdings and shares available inflates the standard errors of both interaction terms. In this case, however, the standard errors are sufficiently inflated so that neither coefficient is significant even at the 10% level

To circumvent the multicolineraity problem, we conduct a double independent sort based on share availability and institutional holdings. First, each firm-quarter observation is assigned to a tercile based on institutional holdings. We also independently assign each firm-quarter into terciles based on shares available for borrowing, so our sample is split into six groups based on institutional holdings and shares available. Using more than six groups would cause some groups to have too few observations to draw meaningful inferences. We retain only those firm-quarter observations for which accruals are in the highest quintile in a given calendar quarter, finally, comparing the abnormal returns for each of the six groups. The results are given in Table 5.

Notice that statistically significant negative abnormal returns only follow high accruals when both institutional holdings and share availability are low. In every other instance, either medium or high institutional holdings or share availability, the accrual anomaly is wholly absent. This finding confirms that having a large number of shares available to borrow does in fact attenuate the accrual anomaly, but only when institutional holdings are low. That the accrual anomaly is not present in high institutional holdings stocks confirms that institutional holdings affect pricing in ways unrelated to short selling, even in cases where the number of shares available to short sellers is low. We conduct a similar analysis for stocks in the lowest quintile of earnings surprise. The results, although untabulated, are qualitatively similar.

4 Conclusion

This paper sheds light on the determinants of short selling and the effect of short selling on asset prices. It documents that short sellers, holding short positions after the public release of earnings, exploit market underreactions to negative earnings surprises. In contrast to Christophe, et al. (2004), who document that short sellers anticipate earnings surprise, we find that short sellers initiate and continue to hold short positions in response to earnings news even after it has been made public. This paper tests how PEAD and accruals jointly affect short interest, in contrast to Hirshleifer et al. (2006), Zhang and Cready (2004) and Richardson (2003), who test the effect of accruals in isolation. We find that short sellers' responses to high accruals are enhanced when unexpected earnings are higher. Finally, this paper documents that short sellers play an important role in reducing the overpricing of both income-increasing accruals and earnings surprise.

Traditional asset pricing theory asserts prices arrive at their true values quickly because markets are frictionless. However, in the context of earnings information, market prices deviate from true values in systematic ways. Recent literature has revealed mechanisms by which arbitrage is limited, which helps to explain the apparent paradox.

By showing that arbitrageurs reduce mispricing around earnings announcements, this paper provides support for the notion that limits to arbitrage contribute to mispricing. As such, the paper identifies a how market mispricing can be reduced from a regulatory perspective. It also demonstrates that policies that improve the ease of short selling, such as the rescinding of price tests in the SEC's Regulation SHO, are likely to have beneficial effects on the level of mispricing around earnings announcements. This reduction in mispricing can lead to important improvements in the valuations of portfolios held by individuals and institutions.

References

Amihud, Y., 2002. Illiquidity and Stock Returns: cross-section and time series effects. Journal of Financial Markets 5, 31-56.

Asquith, P. and L. Muelbrook, 1996. An Empirical Investigation of Short Interest, Unpublished Working Paper, MIT.

Asquith, P., P. Pathak, and J. Ritter, 2005. Short Interest, Institutional Ownership, and Stock Returns. Journal of Financial Economics 78, 243-76.

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.

Bernard, V.L. and T.J. Thomas, 1989. Post-Earnings Announcement Drift: Delayed Price Response or Risk Premium? Journal of Accounting Research 27, 1-36.

Bernard, V.L. and T.J. Thomas, 1990. Evidence that Stock Prices do not Fully Reflect the Implications of Current Earnings for Future Earnings, Journal of Accounting and Economics 13, 305-340.

Baruch, B., 1917. Testimony before the Committee on Rules. House of Representatives.

Boehme, R., Danielsen, B.R. and S.M. Sorescu, 2006. Short Sale Constraints, Differences of Opinion, and Overvaluation. Journal of Financial and Quantitative Analysis 41, 455-487.

Brent, A., D. Morse and E.K. Stice, 1991. Short Interest: Explanations and Tests. Journal of Financial and Quantitative Analysis 25, 273-289.

Cameron, C., J. Gelbach and D. Miller, 2006. Robust Inference with Multi-way Clustering. NBER Technical Working Paper #R0327.

Chancellor, E., 2001. A Short History of the Bear. Guest Analysis, www.theprudentbear.com, October 29, p. 6.

Chen, J. H. Hong and J. Stein, 2002. Breadth of ownership and stock returns. Journal of Financial Economics 66, 717-205.

Christophe, S., M. Ferri, and J. Angel, 2004. Short-Selling Prior to Earnings Announcements. Journal of Finance 59, 1845-75.

Cohen, L, Diether, K and C. Malloy, 2007. Supply and Demand Shifts in the Shorting Market. Journal of Finance 63, 2061-2096.

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, and P. Hribar., 2003. Investor Sophistication and the mispricing of Accruals. Review of Accounting Studies 8, 251-276.

D'Avolio, Gene, 2002, "The market for borrowing stock," Journal of Financial Economics, 66, 271-306.

Danielsen, B.R. and S.M. Sorescu, 2001. Why Do Option Introductions Depress Stock Prices? A Study of Diminishing Short-Sale Constraints. Journal of Financial and Quantitative Analysis 36, 451-484.

Dechow, P. A., R. Sloan and A. Sweeney, 1995. Detecting Earnings Management. The Accounting Review 20, 193-225.

Dechow, P. A. Hutton, L. Meulbroek and R. Sloan, 2001. Short-sellers, Fundamental Analysis and Stock Returns. Journal of Financial Economics 61, 77-106.

Defond, M. and J. Jiambalvo, 1994. Debt Covenant Violation and the Manipulation of Accruals. Journal of Accounting and Economics 17, 154-176.

Defond, M. and C. Park, 2001. The Reversal of Abnormal Accruals and the Market Valuation of Earnings Surprises. The Accounting Review 76, 375-404.

Desai, H., K. Ramesh, S. R. Thiagarajan and B.V. Balachandran, 2002. An Investigation of the Informational Role of Short Interest in the NASDAQ Market. Journal of Finance 57, 2263-87.

Desai, H., S. Krishnamurthy and K. Venkataraman, 2006a. Do short sellers target firms with poor earnings quality? Evidence from Earnings Restatements. Review of Accounting Studies 11, 71-90.

Desai, H., S. Krishnamurthy and K. Venkataraman, 2006b. On distinguishing between valuation and arbitrage-motivated short selling. Unpublished Working Paper, Southern Methodist University.

Fama, E., 1998. Market Efficiency, Long-Run Returns, and Behavioral Finance. Journal of Financial Economics 49, 283-306.

Foster, C., 1977. Quarterly Accounting Data: Time Series Properties and Predictive-Ability Results. The Accounting Review 52, 1-21.

Foster, G., C. Olsen and T. Shevlin, 1984. Earnings Releases, Anomalies, and the Behavior of Security Returns. The Accounting Review, 574-603.

Figlewski, S. and G.P. Webb, 1993. Options, Short Sales, and Market Completeness. Journal of Finance 48, 463-476.

Geczy, C., D. Musto and A. Reed, 2002. Stocks are Special Too: An Analysis of the Equity Lending Market. Journal of Financial Economics 66, 241-269.

Hirshleifer, D., S.H. Teoh and J. Yu.(2006 Do Short Sellers Arbitrage Accounting-Based Stock Market Anomalies? Papers and Proceeds of the American Finance Association Meetings, Boston.

Jenter, D., 2005. Market Timing and Managerial Portfolio Decisions, Journal of Finance 60, 1903-1949.

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

Jones, J., 1991. Earnings management during import relief investigations. Journal of Accounting Research 29, 193-228.

Ke, B. and S. Ramalingegowda, 2005. Do Institutional Investors Exploit the Post-Earnings Announcement Drift? Journal of Accounting and Economics 39, 25-53.

Kolasinski, A. and X. Li, 2004. Teaching by Trading: Examining the Impact of Insider Trading on Post-Earnings Announcement Drift. Unpublished Working Paper, UT Dallas.

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

Kothari, S. A. Leone and C. Wasley, 2005. Performance Matched Discretionary Accrual Measures. Journal of Accounting and Economics 39, 163-97.

Lamont, O., 2004. Going Down Fighting: Short Sellers vs. Firms, NBER Unpublished Working Paper #10659.

Louis, H., 2004. Earnings Management and the Market Performance of Acquiring Firms, Journal of Financial Economics 74, 121-148.

Mashruwala, C., S. Rajgopal, and T. Shevlin, 2006. Why is the Accrual Anomaly not Arbitraged Away? Journal of Accounting and Economics 42, 3-33.

Nagel, S., 2005. Short Sales, Institutional Investors, and the Cross-Section of Stock Returns. Journal of Financial Economics 78, 277-309.

Ofek, E., M.P. Richardson and R. Whitelaw, 2003. Limited Arbitrage and Short Sales Restrictions: Evidence from the Options Markets, Journal of Financial Economics 74, 305-342.

Reed, A.V., 2007. Costly Short-Selling and Stock Price Adjustments to Earnings Announcements, Unpublished Working Paper, UNC.

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

Schleifer, A. and L. Summers. "The Noise Trader Approach to Finance." Journal of Economic Perspectives 4, 19-33.

Sloan, R. G., 1996. Do Stock Prices Fully Reflect Information in Accruals and Cash Flows about Future Earnings? Accounting Review, 71, 289-315.

Xie, H., 2001. The Mispricing of Abnormal Accruals, Accounting Review 76, 357-373.

Zhang, Y. and W. Cready., 2004 Do Speculative Short Sellers Detect Earnings Management? Papers and Proceedings of the American Accounting Association Meetings.

Figure 1
Mean short interest per share over the sample period of 1995 – 2006

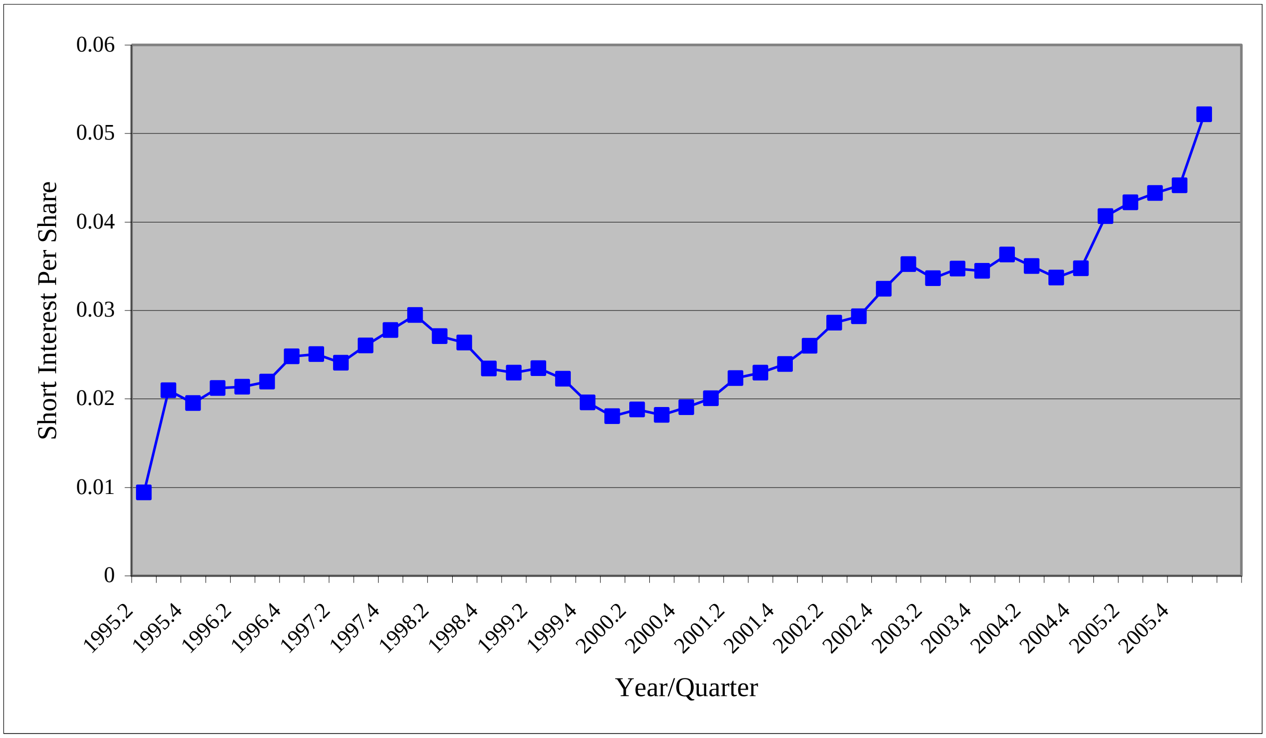

Figure 2
Histogram of Short Interest Positions

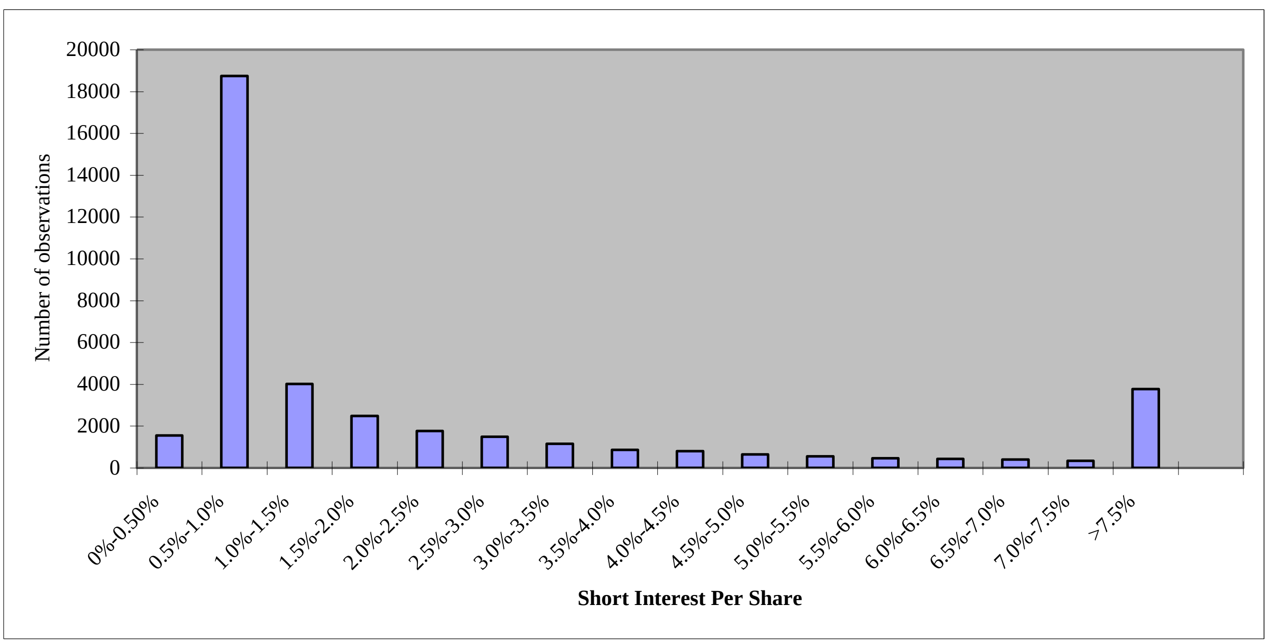

Figure 3
Timeline

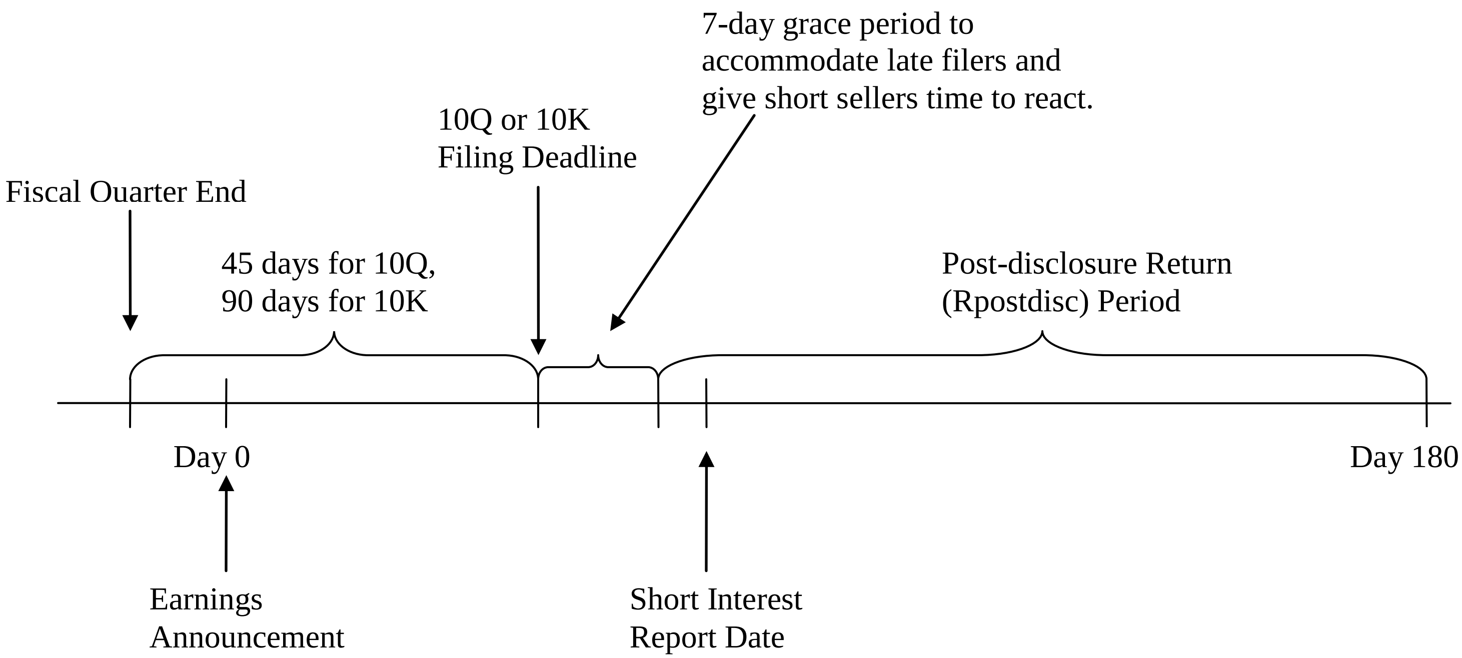

Table 1
Descriptive Statistics & Variable Definitions

Variable	N	Mean	Std Dev	Minimum	25th Pctl	50th Pctl	75th Pctl	Maximum
sips	32518	0.024	0.043	0.000	0.001	0.006	0.028	0.247
highsi	32518	0.042	0.201	0	0	0	0	1
sue	32518	-0.043	1.060	-2.509	-0.701	-0.015	0.655	2.195
pmda	32518	-0.006	0.146	-0.852	-0.034	-0.002	0.030	0.607
highsue	32518	0.099	0.299	0	0	0	0	1
lowsue	32518	0.099	0.299	0	0	0	0	1
highpmda	32518	0.092	0.289	0	0	0	0	1
lowpmda	32518	0.096	0.295	0	0	0	0	1
oplist	32518	0.305	0.460	0.000	0.000	0.000	1.000	1.000
insthld	32518	0.336	0.267	0.000	0.107	0.281	0.520	0.968
nanalysts	32518	3.312	3.854	0	1	2	5	38
lnmv	32518	4.779	1.473	-0.556	3.768	4.800	5.816	11.653
bm	32518	0.629	0.569	0.000	0.257	0.455	0.797	3.128
turn	32518	0.008	0.011	0.000	0.002	0.004	0.009	0.079
Illiquidity	32518	2.533	7.412	0.000	0.017	0.106	0.927	43.342
shares_available	7748	0.043	0.056	0.000	0.000	0.015	0.069	0.233
Rpostdisc	7748	0.001	0.344	-0.838	-0.200	-0.031	0.115	2.013

sips	Short interest per share: total number of shares held short, deflated by the number of shares outstanding, as of the first settlement date after the SEC deadline to file quarterly and/or annual financial statements.
highsi	Dummy indicating that sips is above the 95th percentile.
surprise	Standardized unexpected earnings: difference between actual and expected earnings divided by standard deviation in unexpected earnings. Expected earnings are computed using a 12 quarter seasonal random-walk with drift model.
accruals	Performance-adjusted discretionary accruals.
arbrisk	A proxy for arbitrage risk: standard deviation of idiosyncratic volatility of monthly returns during the 4 years prior to an earnings announcement
oplist	A dummy indicating that the stock has publicly traded listed options
insthld	Institutional holdings deflated by shares outstanding last available before an earnings announcement
nanalysts	Number of analysts covering the stock before the earnings announcement.
lnmv	The natural log of the market value of equity, in millions, at end of quarter t.
bm	Book-to-market ratio measured at end of the calendar quarter previous to the earnings announcement
turn	Share turnover: the average daily trading volume during the short-interest accumulation period deflated by the number of shares outstanding.
Illiquidity	The Amihud (2002) illiquidity measure, defined as the average ratio of the absolute daily return to the total daily dollar volume over the period from 30 to 90 days before the earnings announcement. The average of the opening and closing price is used to compute the dollar volume for a given day.
Rpostdisc	The post-disclosure size-adjusted buy-and-hold return, which is computed over the period beginning one week after the SEC deadline to file financial statements and ending 182 days after the earnings announcement.
available	The average the daily number of shares investors have made available for borrowing by short sellers from 30 to 90 days before the earnings announcement deflated by total shares outstanding.

Table 2
OLS tests of the Short Seller Exploitation Hypothesis (H1)

This table presents parameter estimates of a panel data regression of short interest per share on standardized unexpected earnings (surprise) and performance-adjusted discretionary accruals (accruals). Both surprise and accruals are partitioned according to whether they are positive or negative, as indicated with a + or - superscript. All other variables are defined in Table 1. Models 1-4 conducts the analysis using levels, and Model 5 uses changes. The quarterly panel data sample spans the period from 1995 to 2006. The intercept and estimates of calendar quarter fixed are not reported. Standard errors, in parenthesis, are robust to heteroskedasticity, serial and cross-sectional error correlation.

		Analysis of short interest/share levels				Analysis of Changes	
	Prediction	Model 1	Model 2	Model 3	Model 4		Model 5
surprise^{+}	?	0.000	-0.000	0.000	0.000	chngsurprise	-0.001***
		(0.001)	(0.001)	(0.001)	(0.001)		(0.000)
surprise^{-}	+	0.002***	0.002***	0.002***	0.002***		
		(0.001)	(0.001)	(0.001)	(0.001)		
accruals^{+}	+	0.009**	0.006	0.009**	0.012***	chngaccurals	0.002*
		(0.004)	(0.004)	(0.004)	(0.004)		(0.001)
accruals^{-}	?	-0.001	-0.001	0.000	-0.001		
		(0.003)	(0.003)	(0.003)	(0.003)		
surpise^{+}$*$accruals^{+}	+		0.008**				
			(0.003)				
surpise^{-}$*$accruals^{-}	-			-0.002			
				(0.003)			
surpise^{-}$*$accruals^{+}	?				-0.006		
					(0.004)		
arbrisk	+	0.020***	0.020***	0.020***	0.020***	chngarbrisk	0.014
		(0.006)	(0.006)	(0.006)	(0.006)		(0.009)
oplist	+	0.019***	0.019***	0.019***	0.019***	chngoplist	0.010***
		(0.002)	(0.002)	(0.002)	(0.002)		(0.001)
insthld	+	0.031***	0.031***	0.031***	0.031***	chnginsthld	0.055***
		(0.004)	(0.004)	(0.004)	(0.004)		(0.006)
nanalysts	?	0.000	0.000	0.000	0.000	chngnanalysts	0.001***
		(0.000)	(0.000)	(0.000)	(0.000)		(0.000)
lnmv	?	0.001*	0.001*	0.001*	0.001*	chnglnmv	0.001
		(0.001)	(0.001)	(0.001)	(0.001)		(0.001)
bm	-	-0.005***	-0.005***	-0.005***	-0.005***	chngbm	0.001
		(0.001)	(0.001)	(0.001)	(0.001)		(0.001)
illiquidity	-	0.000***	0.000***	0.000***	0.000***	chngilliquidty	0.000**
		(0.000)	(0.000)	(0.000)	(0.000)		(0.000)
turnover	+	1.407***	1.407***	1.407***	1.406***	chngturnover	0.896***
		(0.108)	(0.108)	(0.108)	(0.108)		(0.079)
Observations		31184	31184	31184	31184	Observations	21765
R-squared		0.39	0.39	0.39	0.39	R-squared	0.19

Robust standard errors in parentheses, clustered by firm and calendar quarter

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3

Alternative specifications for the Short Seller Exploitation Hypothesis (H1)

This table presents panel data logistic regressions where the dependent variable is a dummy indicating that short interest exceeds the 90th percentile for a given firm. The dependent variables include standardized unexpected earnings (surprise) and performance-adjusted discretionary accruals (accruals). Both surprise and accruals are partitioned according to whether they are positive or negative, as indicated with a + or - superscript. All other variables are defined in Table 1. The intercept and estimates of calendar quarter fixed effects are not reported. Standard errors, in parenthesis, are robust to heteroskedasticity, serial and cross-sectional error correlation.

	Prediction	Model L1	Model L2	Model L3	Model L4
$surprise^{+}$	?	-0.050	-0.045	-0.051	-0.050
		(0.061)	(0.068)	(0.061)	(0.061)
$surprise^{-}$	+	0.158***	0.158***	0.193***	0.142**
		(0.054)	(0.054)	(0.055)	(0.056)
$accruals^{+}$	+	-0.013	0.048	-0.031	-0.270
		(0.313)	(0.320)	(0.312)	(0.463)
$accruals^{-}$	?	-0.603***	-0.603***	-0.182	-0.605***
		(0.223)	(0.223)	(0.242)	(0.224)
$surpise^{+} * accruals^{+}$	+		-0.158		
			(0.475)		
$surpise^{-} * accruals^{-}$	+			-1.056***	
				(0.330)	
$surpise^{-} * accruals^{+}$	?				0.431
					(0.416)
arbrisk	+	-0.432	-0.432	-0.428	-0.431
		(0.378)	(0.378)	(0.378)	(0.378)
oplist	+	0.040	0.040	0.040	0.039
		(0.083)	(0.083)	(0.083)	(0.082)
insthld	+	0.866***	0.866***	0.861***	0.865***
		(0.207)	(0.207)	(0.207)	(0.207)
nanalysts	?	-0.051***	-0.051***	-0.051***	-0.051***
		(0.012)	(0.012)	(0.012)	(0.012)
lnmv	?	-0.017	-0.017	-0.017	-0.018
		(0.049)	(0.049)	(0.049)	(0.050)
bm	-	-0.333***	-0.333***	-0.334***	-0.335***
		(0.082)	(0.082)	(0.082)	(0.082)
illiquidity	-	-0.008	-0.008	-0.008	-0.008
		(0.007)	(0.007)	(0.007)	(0.007)
turnover	+	29.266***	29.265***	29.263***	29.295***
		(2.114)	(2.114)	(2.116)	(2.117)
Observations		31184	31184	31184	31184

Robust standard errors in parentheses, clustered by firm and calendar quarter.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4
OLS Analysis of the Overpricing Reduction Hypothesis (H2)

This table presents parameter estimates of panel data regressions of long-run abnormal buy-and-hold returns after the disclosure of financial statements (Rpostdisc, as defined in Table 1) on shares available for borrowing (available), a accruals, earnings surprise, interaction terms, and various other variables defined in Table 1. Both surprise and accruals are partitioned according to whether they are positive or negative, as indicated with a + or - superscript. The variables badsurprise, goodsurprise, lowaccruals, highaccruals, are dummies indicating whether accruals and surprise are in the bottom and top quintiles in their quarter The sample period stems from October, 2004 to June, 2006. The intercept is not reported.

Panel A: Shares Available for Borrowing and Pricing of Earnings Surprise

	Prediction	Model 6	Model 7	Model 8	Model 9
available*surprise$^-$	+	0.258***	0.211**	0.246***	0.189*
		(0.095)	(0.095)	(0.073)	(0.110)
illiquidity*surprise$^-$	-		-0.008***		
			(0.003)		
arbrisk*surprise$^-$	-			-0.026	
				(0.097)	
insthld*surprise$^-$	+				0.020
					(0.028)
available	None	0.073	0.096	0.078	0.104
		(0.134)	(0.134)	(0.121)	(0.124)
surprise$^+$	+	-0.001	-0.001	-0.001	-0.001
		(0.005)	(0.005)	(0.005)	(0.005)
surprise$^-$	-	-0.035***	-0.030***	-0.030**	-0.042***
		(0.012)	(0.011)	(0.014)	(0.015)
accruals$^+$	-	-0.125***	-0.127***	-0.125***	-0.125***
		(0.033)	(0.032)	(0.034)	(0.033)
accruals$^-$	+	0.047	0.049	0.047	0.047
		(0.115)	(0.116)	(0.116)	(0.117)
illiquidity	+	-0.001	0.000	-0.001	-0.001
		(0.002)	(0.003)	(0.002)	(0.002)
insthld	?	-0.010	-0.011	-0.010	-0.019
		(0.040)	(0.040)	(0.041)	(0.043)
arbrisk	?	-0.001	-0.007	0.010	-0.002
		(0.081)	(0.082)	(0.093)	(0.081)
bm	+	0.025	0.025	0.025	0.025
		(0.022)	(0.022)	(0.022)	(0.022)
lnmv	-	-0.014	-0.014	-0.014	-0.014
		(0.009)	(0.009)	(0.009)	(0.009)
Observations		4808	4808	4808	4808
R-squared		0.01	0.01	0.01	0.01

Robust standard errors in parentheses, clustered by firm and calendar quarter
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4(Cont)

Panel B: Shares Available for Borrowing and the Pricing of Accruals

	Prediction	Model 10	Model 11	Model 12	Model 13
available*accruals$^+$	+	4.158**	4.199**	4.115***	3.652
		(1.749)	(1.703)	(1.593)	(2.901)
illiquidity*accruals$^+$	-		0.023		
			(0.021)		
arbrisk*accruals$^+$	-			-0.077	
				(0.449)	
insthld*accruals$^+$	+				0.122
					(0.421)
available	None	0.093	0.088	0.095	0.113
		(0.127)	(0.124)	(0.122)	(0.139)
surprise$^+$	+	-0.001	-0.001	-0.001	-0.001
		(0.005)	(0.005)	(0.005)	(0.005)
surprise$^-$	-	-0.021***	-0.021***	-0.021***	-0.021***
		(0.007)	(0.007)	(0.007)	(0.007)
accruals$^+$	-	-0.259***	-0.274***	-0.242***	-0.289**
		(0.046)	(0.050)	(0.069)	(0.115)
accruals$^-$	+	0.047	0.047	0.047	0.048
		(0.117)	(0.117)	(0.117)	(0.116)
illiquidity	+	-0.001	-0.002	-0.001	-0.001
		(0.002)	(0.002)	(0.002)	(0.002)
insthld	?	-0.012	-0.012	-0.012	-0.017
		(0.041)	(0.042)	(0.041)	(0.044)
arbrisk	?	-0.001	-0.001	0.003	-0.001
		(0.080)	(0.080)	(0.082)	(0.080)
bm	+	0.025	0.026	0.025	0.025
		(0.022)	(0.022)	(0.022)	(0.022)
lnmv	-	-0.014	-0.014	-0.014	-0.014
		(0.009)	(0.009)	(0.009)	(0.009)
Observations		4808	4808	4808	4808
R-squared		0.01	0.01	0.01	0.01

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4(Cont)

Panel C: Extreme Value Specifications

	Prediction	Model 10	Model 10
available*badsurprise	+	0.281**	
		(0.128)	
available*highaccruals	+		0.579***
			(0.202)
available	None	0.142	0.127
		(0.124)	(0.122)
highaccruals	-	-0.012*	-0.036***
		(0.007)	(0.013)
lowaccruals	+	0.037***	0.036***
		(0.010)	(0.010)
goodsurprise	+	0.007	0.007
		(0.012)	(0.012)
badsurprise	-	-0.041***	-0.025***
		(0.012)	(0.008)
illiquidity	+	-0.001	-0.001
		(0.002)	(0.002)
insthld	None	-0.009	-0.011
		(0.038)	(0.039)
arbrisk	None	-0.013	-0.014
		(0.078)	(0.078)
bm	+	0.027	0.026
		(0.022)	(0.022)
lnmv	-	-0.014	-0.014
		(0.009)	(0.009)
Observations		4808	4808
R-squared		0.01	0.01

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5
Distinguishing Between the Effect of Institutional Holdings and Shares Available for Loan

This table presents mean long-run abnormal (size-adjusted) returns after the 10Q or 10K filing deadline for various groups of high accrual firm-quarter observations. A firm-quarter observation is deemed to be "high accrual" if it is in the highest accrual quintile within the calendar quarter. Firms are assigned to groups based on their institutional holdings and share availability qunatiles. The return horizon begins one week after the filing deadline and ends 180 days after the earnings announcement. Standard errors are in parentheses. Statistical significance is indicated with asterisks: *** corresponds to the 1% level, ** to the 5% level, and * to the 10% level.

		Institutional Holdings Qunatile		
		Low	Medium	High
Shares Available Quantile	Low	-0.058***	0.022	0.004
	Medium	0.067	-0.021	-0.0226
	High	0.078	-0.0329	0.0245