Don't shoot the messenger (or the short seller)!

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Abstract

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Abstract

We demonstrate that low returns of highly shorted stocks are due to short sellers' ability to predict future firm performance. We assert that short-sellers are informed investors who merely predict negative stock returns by correctly anticipating negative earnings surprises, unfavorable public news, and downgrades in analyst earning forecast. Their trading pattern is consistent with them anticipating the direction of future news, and their trades do not appear to contribute to price declines. Quite to the contrary, we find that stock prices actually appreciate when short sellers increase their positions.

In the midst of the 2008 financial crisis, the Securities and Exchange Commission temporarily banned investors from shorting the stock of financial institutions. The SEC justified the action by observing that under the prevailing market conditions, "unbridled short selling is contributing to the recent, sudden price declines in the securities of financial institutions unrelated to true price valuation" (SEC release 2008-211).

SEC's assertion is at odds with the long-held view among professional short-sellers that shorting does not cause, but merely anticipates, price declines. For example, during his testimony before the US Congress, James Chanos of *Kynicos Associates* argued that short-sellers are merely "detectives" who are *uncovering*, not contributing to, financial disasters:

> Finally, I want to remind you that, despite two hundred years of "bad press" on Wall Street, it was those "un-American, unpatriotic" short sellers that did so much to uncover the disaster at Enron and at other infamous financial disasters during the past decade (Sunbeam, Boston Chicken, etc.). While short sellers probably will never be popular on Wall Street, they often are the ones wearing the white hats when it comes to looking for and identifying the bad guys! *James Chanos, House Committee on Energy and Commerce (February 6, 2002).*

Both views imply a negative intertemporal association between the current levels of short interest and future stock returns, a finding that has long been established in the academic literature.[1] However, this finding alone cannot discriminate between the "detective" view of short selling embraced by industry participants, and the less flattering view of short selling that is apparently implicit in SEC's justification of the short ban. In both cases we would expect to see lower stock returns following unusually high shorting activity.

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[1] See, e.g. (Boehmer, Jones, and Zhang (2007), Boeheme et al. 2006, Asquith, Pathak, and Ritter 2005, Asquith and Meulbroek 1996, Desai et al. 2002

In this paper we attempt to shed some light on the reasons of such price behavior. Using a sample of short-interest from the 1988-2005 period, we find evidence consistent with the "detective" view embraced by James Chanos and others. Short sellers do not appear to be the cause of stock price declines. Instead, they are informed investors who take positions in stocks that are about to experience a decline in fundamental value. In this capacity, short-sellers join the ranks of stock analysts, institutional investors, underwriters, auditors, and bank lenders, who have been shown to provide similar information-acquiring functions.[2]

We show that short sellers take positions in stocks that are about to experience (a) unfavorable public news, (b) negative earning surprises, and (c) downgrades in analyst forecast. Because these three events are more likely to capture changes in *fundamental* rather than *market* value, it is likely that they would have happened even in the absence of short selling. Moreover, return predictability is closely related to short sellers' ability to anticipate future changes in fundamentals. Again, it is highly unlikely that short-sellers are the ones causing the news. Instead, a more likely explanation is that short sellers are able to detect problems waiting to happen and take short positions ahead of other market participants. Finally, we show that the contemporaneous relation between stock returns and changes in short interest is *positive.* If shorting were contributing to the price decline,

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[2] For example, underwriter quality has been shown to influence the extent of IPO underpricing (Beatty and Ritter, 1986; Carter and Manaster, 1990), as has the identity of an IPO firm's auditors (Beatty, 1989). A long literature documents the positive effect of bank loan announcements on a firm's stock price (e.g., Mikkelson and Partch, 1986; James, 1987; Lummer and McConnell, 1989), including the finding that announced loans from higher-quality lenders are associated with more positive borrower abnormal returns (Billett, Flannery, and Garfinkel, 1995). Also, Brennan and Subramanyam (1995) report that the equity of firms which are followed by a larger number of investment analysts trade with smaller bid-ask spreads, reflecting lower informational asymmetries across traders in the market. Finally, Boehmer and Kelley (2007) report that institutional investors improve the efficiency of security prices.

as conjectured by SEC, this relation would be *negative.* Thus, at least for firms in our sample, SEC's assertion that shorting can destabilize market prices is unsupported.

Our findings build on a broadening base of empirical research demonstrating that short sellers are well informed traders. Short-sale practitioners tend to be investors with superior analytical skills (Gutfleish and Atzil, 2004), and typically initiate short positions when they can infer low fundamental valuation from public sources. For example, short sellers may engage in forensic accounting, looking for high levels of accrual as evidence of hidden bad news (Sloan, 1996). Or they may examine divergence between earnings and cash flows, or abnormally elevated price-earning ratios. As a result, they earn substantial abnormal returns on their trading (Boehmer, Jones, and Zhang, 2007). But the adjustment to shorters' information is not instantaneous; in fact, Boehmer et al. show that abnormal returns on shorting strategies persist for up to 60 days. Therefore, short interest—the level of outstanding shorts—could have predictive power for future returns.

Our results are similar to the argument in Diamond and Verrechia (1987), but with an important difference. Their model assumes a pure rational expectations economy where the level of short interest is publicly observable and its informational content is incorporated into stock prices immediately. Therefore, in their model short interest predicts declines in fundamental value, but not in market value. But price adjustment to short sellers' information is far from instantaneous (see Boehmer, Jones, and Zhang, 2007). This suggests a limits-to-arbitrage setting, where stock prices do not incorporate information immediately. We believe that this is a sensible approach, because trading strategies based on short interest tend to be risky. For example, a trading strategy that consistently shorts stocks in the highest short interest decile and goes long on stocks in the lowest short interest decile will earn an average return of 1.51% per month. But this return varies over time. The strategy has a beta of 0.69 and a standard deviation of 5.1%. In fact, the Sharpe ratio of this strategy (0.23) is comparable to the Sharpe ratio of investing in the CRSP value weighted market index (0.16). Consequently, risk-averse arbitrageurs may not be able to exploit overvaluation immediately. Moreover, shorting strategies are subject to additional risks that confound this effect. For example, an early liquidation forced by a short squeeze could force short sellers out of their position before the stock can move in the expected direction (De Long et al., 1990). Finally, the risk associated with these strategies may limit short sellers' ability to raise capital from third parties (Shleifer and Vishny, 1997). For these reasons, we believe that Diamond and Verrechia's model is best interpreted in combination with a limits-to-arbitrage argument, and our analysis builds on this insight.

Overall, our results are consistent with informed short sellers and the idea that the level of their holdings, short interest, provides value-relevant information about future changes in fundamental value. These results corroborate recent evidence in Boehmer and Kelley (2007) that short sellers contribute in important ways to price discovery in financial markets and imply that restrictions on short selling, such as the recent SEC ban, could impose significant indirect costs on other market participants.

The rest of the paper is organized as follows. In Section I, we describe the data sources and methodology. We present empirical results in Section II and conclude in Section III.

I. Data and methodology

Data on stock returns are from the Center for Research on Security Prices at University of Chicago (CRSP) for all common stocks listed on NYSE, Amex, and

NASDAQ (share code 10 or 11), between January 1988 and December 2005. Monthly short interest, *Short*, is based on outstanding shorts reported by the exchanges, standardized by the number of shares outstanding. Data on institutional ownership are obtained from 13-F filings, available from Thomson Financial. We define institutional holdings, *IO*, as the sum of the holdings of all institutions for each stock in each quarter, divided by the number of shares outstanding obtained from CRSP. Stocks that have available return data but no reported institutional holdings are assumed to have zero institutional ownership.

Size is the market value of equity calculated as the number of shares outstanding times the month-end share price. *B/M* is the ratio of book to market value of equity. Book value is computed as in Fama and French (2002) and measured at the most recent fiscal year-end that precedes the calculation date of market value by at least three months.[3] We exclude firms with negative book values. The stock's momentum (*MOM*) is computed as its raw return over the previous 12 months.

We measure *unexpected public news* using a (signed) count of public news items. We obtain this count from Chan's (2003) news data that covers a random sample of approximately one-quarter of CRSP stocks during the period from 1980 to 2000.[4] In Chan's data, news items are collected from the Dow Jones Interactive Publications Library, by searching through all newspapers with over 500,000 subscribers. For each stock covered, the dataset collects the dates at which the stock was mentioned in the headline or

[3] Book value is defined as total assets (data 6) minus total liabilities (data 181) plus balance sheet deferred taxes and investment tax credit (data 35) minus the book value of preferred stock. Depending on data availability, the book value of preferred stock is based on liquidating value (data 10), redemption value (data 56), or carrying value (data 130), in order of preferences.

[4] We thank Wesley S. Chan for sharing his database.

lead paragraph of an article of one of the publications covered.[5] About half the stocks have at least one news item each month, and less than 5% of stocks have public news during more than five days per month. One limitation of Chan's dataset is that contains no information about the news content. Only a count of news item is given. We use a method similar to Chan's to overcome this limitation and infer the news content: we compute the cumulative abnormal return (CAR) around the date of each news item, chose a *filter threshold* (Φ) and classify the news' content as "positive" when CAR>Φ%, and "negative" when CAR<-Φ%. For CAR values between -Φ% and Φ%, we classify the news item as "neutral." We experiment with two values of Φ: 0.5% and 1.0%.

CARs are computed as the average daily market-adjusted return around the news date, as in Brown and Warner (1985):

$$CAR_i = \frac{1}{4}\sum_{j=-2}^{j=1}(r_{ij} - r_{mj}) \qquad (1)$$

where r_{ij} is the stock i's return on day j and r_{mj} is the return on the equally-weighted CRSP market index on day j. Day j=0 is the news date.

After classifying news items as either positive, negative or neutral in terms of content, we assign numerical values of +1 to all positive news items, zero to all neutral items, and –1 to all negative news items. We then compute two separate monthly aggregate news measures: *NEWS1* and *NEWS2*. For *NEWS1* we add the (signed) values of all news items that month, using Φ = 0.5% as a filter. For *NEWS2* we use Φ = 1.0% as filter. Months with no news items are assigned an aggregate news measure equal to zero.

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[5] For a more detailed description, see Chan (2003).

We measure *earning surprises* using quarterly earnings and announcement dates from COMPUSTAT. We use two measures of earnings surprises: standardized unexpected earnings (*SUE*) and cumulative abnormal returns around the announcement (*CAR*).

Following Foster, Olsen, and Shevlin (1984), we define *SUE* in month *t* as

$$SUE_t = \frac{EPS_q - E[EPS_q]}{\sigma_t} \tag{2}$$

where *q* is the quarter, EPS_q are the most recent quarterly earnings per share, $E[EPS_q]$ are expected earnings per share, and σ_t is the standard deviation of unexpected earnings ($EPS_q - E[EPS_q]$) over the preceding eight quarters. To estimate expected earnings we use a seasonal random walk model as in Chan, Jegadeesh, and Lakonishok (1996):[6]

$$E[EPS_q] = \alpha + EPS_{q-4} \tag{3}$$

The second measure of earnings surprises is the average daily market-adjusted return around the earnings announcement date (*CAR*). Earning-surprise CARs are computed in the same manner as the CARs used infer the content of news items.

We begin with a standard portfolio-sorting approach to test the ability of short interest to predict future returns, unexpected news, and earnings surprises. Each month, we rank stocks on the basis of short interest, changes in short interest, or institutional ownership, and assign them to decile portfolios. For each portfolio we compute either contemporaneous returns (measured over the calendar month of portfolio formation) or subsequent returns (measured over the calendar month following portfolio formation). We

[6] For robustness we also estimate expected earnings using a seasonal AR(1) model: $E[EPS_t] = EPS_{t-4} + \alpha + \beta(EPS_{t-1} - EPS_{t-5})$. The results (untabulated) are very similar to those obtained with the seasonal random walk model.

use both equally weighted raw returns and abnormal returns based on a four-factor model. The latter are computed as the intercept from the following regression:

$$r_{pt} - r_{ft} = \alpha + \beta_1 (r_{mt} - r_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 MOM_t + \varepsilon_{pt} \qquad (4)$$

where $r_{pt} - r_{ft}$ is the portfolio return minus the return on one-month T-bill, $r_{mt} - r_{ft}$ is the market excess return, SMB is the size factor return, HML is the book-to-market factor return, and MOM is the momentum factor return. Factor returns are obtained from Kenneth French's web site at Dartmouth College. Aside from the sorts, we also use a multivariate predictive regression to verify the robustness of our results.

II. Results

We begin by replicating the well known negative relation between short interest and future returns and report the results in Table 1. Panel A of Table 1 shows that heavily shorted stocks underperform lightly shorted stocks by 1.51 percent per month on an absolute basis, and by 1.72 percent on a risk-adjusted basis. For the most heavily shorted stocks (decile 10), the average short interest is 8.8 percent and the average monthly risk adjusted return is -0.52 percent (t= –3.03). The results presented in Panel A are quite similar to those obtained in previous studies. However, as previously noted, these results are not sufficient to refute SEC's hypothesis that shorting is the cause of the price change.

Asquith, Pathak, and Ritter (2005) argue that the level of institutional ownership (IO) is a correlated to the supply of shortable stock. They show that the relation between short interest and future returns is stronger for stocks with low levels of IO. These are difficult to borrow stocks, and we expect their shorts to be particularly well informed. We verify this hypothesis in Panel B of Table 1, where we examine the role of institutional ownership (IO) for the most heavily shorted decile.

Asquith, Pathak, and Ritter (2005) find negative abnormal return only for the lowest IO levels among these heavily shorted stocks. Columns (1) and (2) in Panel B present the average level of IO and short interest for three portfolios sorted on IO. Columns (3) and (4) replicate the findings of Asquith, Pathak and Ritter: both the absolute (*Ret*) and abnormal (α) returns are lowest for the lowest IO group (IO1). Moreover, the difference in returns between the lowest and highest IO groups (IO3-IO1) is always significant at better than the ten percent level. While the results in Panel B are consistent with the hypothesis that short sellers generate value-relevant information, they cannot refute SEC's conjecture that shorting does in fact *cause* the observed price declines. For example, stocks with low institutional ownership are likely to have low liquidity and a higher price impact of trade. This fact could also explain the large negative abnormal returns observed in the top line of Panel B.

We now turn to a series of formal tests designed to assert the validity of SEC's hypothesis that shorting contributes to stock price declines.

A. <u>Short interest as predictor of changes in firm fundamentals</u>

We first ask if short interest can predict future changes in firm fundamentals. If it can, the most likely explanation would be the industry view that short sellers *detect*, but do not *cause*, future negative stock returns. It is difficult to envision how shorting could be the *cause* of changes in firm fundamentals one month ahead. We use subsequent public news and earnings announcements to infer changes in fundamentals. If institutional ownership proxies for supply of shortable stock (Asquith, Pathak, and Ritter, 2005), predictability should be inversely related to the level of institutional ownership (Diamond and Verrechia, 1987).

The results, presented in Tables 2 through 5, provide strong evidence against SEC's assertion. All tables address the ability of short interest to predict future unexpected earnings but the tables differ in terms of dependent variable as well as econometric approach. Tables 2 and 4 use public news count as dependent variable. Tables 3 and 5 use earning surprises. The econometric approach in Tables 2 and 3 is based on portfolio sorts. In Tables 4 and 5 we use Fama-Macbeth regressions.

A.1. Portfolio sorts

We first examine the relation between short interest and future news content. If short sellers are merely *detectives* of future bad news, heavily shorted stocks will be followed by unfavorable public news. The results, presented in Table 2, readily confirm this hypothesis. Panel A of Table 2 shows the univariate relation between current short interest and future news content. As conjectured, stock with the highest level of short interest are followed by predominantly negative public news. Moreover, the relation between short interest and news content is negative and nearly-monotonic. To assess the statistical significance of this relation we compute the difference in news content between stocks belonging to the top and bottom short interest decile. This difference, shown at the bottom of the panel, is significant at the 1% level.

In Panel B of Table 2 we explore the incremental role of institutional ownership. In the top half of the panel we use the *NEWS1* signed count as a proxy for public news, and in the bottom half we use *NEWS2*. If institutional ownership is correlated with the supply of lendable shares (Asquith, Pathak, and Ritter), we would expect the relation between short interest and future news content to be stronger for lower levels of institutional ownership, since shorts are more likely to be informed in this case (Diamond and Verrecchia).

We first sort stocks into quarterly quintiles based on the level of institutional ownership (IO), and then sort each IO quintile into quintiles based on the level of short interest. We then compute next month's average news items for each of the 25 portfolios (signed), and average these across quarters. The bottom lines from each half of Panel B provides weak support for our conjecture. The predictive ability of short interest, measured as the difference in news count between the top and bottom short interest quintile, is decreasing in institutional ownership, although the relation is not monotonic.

In Panel C of Table 2 we use firm *size* as a proxy for the supply of lendable shares, instead of institutional ownership. The results are now much more supportive of our conjecture. The results presented in bottom line in each half of the panel are clearly decreasing in *size*, suggesting that short interest can better predict future news among small stocks that are difficult to short.

Having shown that short interest predicts public news content in general, we now turn to a specific type of public news—earning surprises. Can short interest predict future earning surprises, and is this prediction stronger for stocks that are more difficult to short? We answer both questions in the affirmative.

The results are reported in Table 3. Panel A of Table 3 reports descriptive statistics about earnings surprises during our sample period. We sort stocks into quintiles based on standardized unexpected earnings (SUE). For each group, we report the average value of SUE, as well as the average cumulative abnormal returns (CARs) surrounding earning announcements. As expected, the two measures are highly correlated. Stocks with the most positive earnings surprises earn a CAR of 0.53% per day during the four-day announcement window. At the other extreme, CARs are –0.43% per day for stocks with the most negative earning surprises.

In Panel B we sort stocks into quarterly short interest quintiles and compute the next quarter's earning surprises (SUE and CARs) for each quintile. These are then averaged intertemporally, across all quarters. We find that short interest can indeed predict future earning surprises. In the case of SUE, stocks with the highest short interest predict lower future values of SUE than stocks with lower short interest, and the difference is significant at the ten percent level. The predictability is even more striking when CARs are used as a measure of earning surprises: a hedge portfolio that is long in lightly shorted stocks and short in heavily shorted stocks earns 0.31 percent per day during the four days surrounding earning announcements, and this return is statistically significant at better than the 1% level. These results provide *prima facie* evidence that short interest is quite informative about changes in fundamentals that are yet to be incorporated into stock prices.

We explore the incremental role of institutional investors in Panels C and D. As we did in Table 5, we first sort stocks into quarterly quintiles based on the level of institutional ownership (IO), and again sort each IO quintile into quintiles based on short interest. We compute next quarter's earning surprises for each of the 25 portfolios, and average these across quarters. Panel C reports the results obtained with the SUE measure of earning surprises. The results obtained with the CAR measure are reported in Panel D. Consistent with the results presented in Table 2, the predictive power of short interest decreases monotonically with institutional ownership. For example, in Panel D, among stocks with low institutional ownership (IO1), a hedge portfolio that takes long positions in heavily shorted stocks and short positions in lightly shorted stocks earns an abnormal return of 0.70

percent per day (t=7.13) around earning announcements. This value drops to 0.04 percent (t=0.35) for stocks with high levels of institutional ownership (IO5), but hedge portfolio returns are significant at the five percent level for each of the other IO quintiles. The results obtained with SUE in Panel C are very similar.

Panels E and F repeat the analysis of Panels C and D using firm *size* instead of *IO* as proxy for lendable shares. The results are qualitatively similar to those obtained in the previous two panels. For example, in Panel F we see that short interest predicts earning surprises only among stocks in the lowest three *size* quartiles, which are presumably more difficult to borrow.

Overall, the evidence in Tables 2 and 3 is inconsistent with SEC's conjecture that shorting contributes to stock price declines. Instead we show that short sellers are more likely to detect (rather than contribute to) future stock price declines because they are particularly informed about future changes in firm fundamentals.

A.2. Fama-Macbeth regressions

The portfolio sorting method allows for non-monotonic relationships between the sorting variable and the analysis variable, but a possible shortcoming is that correlations with excluded variables could result in spurious relations. To address this concern, we now estimate Fama-Macbeth regressions in which the dependent variable is, alternatively, the signed news count and the earnings surprise. The independent variables of interest are the level of short interest and institutional ownership. Since the predictive power of short interest is expected to be stronger for lower levels of institutional ownership, we add an interactive term which is the product of these two variables. In addition, we control for size, book-to-market, and momentum. We predict a negative sign on the short interest variable and a positive sign on the interaction term of short interest and institutional ownership. The results based on public news count are presented in Table 4, while those using earning surprises are presented in Table 5.

Panel A of Table 4 presents results using the actual values of the independent variables. In Panel B, we transform all independent variables into decile ranks and then standardize these ranks to take values between zero and one. This transformation makes the coefficient interpretation more intuitive and comparable across variables, in addition to minimizing the effect of outlier observations. In both panels, we run cross-sectional regressions each quarter and compute time-series averages of the coefficient estimates, as in Nagel (2005).

Similar to the results of Table 2, we find that short interest predicts subsequent public news content. The coefficient of *short* is always significant and negative in both panels. We again find weak support for the secondary hypothesis that *short*'s predictability is stronger for low levels of institutional ownership (*IO*). In Panel A, the coefficient of the interactive *short*IO* term is positive and significant only for the *NEWS2* measure in column (3). When *NEWS1* is used instead of *NEWS2* (column (1)), the interaction coefficient remains positive but does not attain significance at traditional levels. This also the case in Panel B where both interaction coefficients (columns (1) and (3)) are positive, but insignificant.

We now turn to Table 5, where earning surprises are used as dependent variables. Table 5 follows the same structure as Table 4. In Panel A we present results using actual values for the independent variables, and in Panel B we use standardized values of these same variables. As previously, we employ two measures of earning surprises. Columns

(1) and (2) in each panel use SUE as proxy for earning surprises. Columns (3) and (4) use CARs.

As in Table 3 we find that short interest predicts subsequent earnings announcement surprises, and this predictability decreases with institutional ownership. The coefficient of *short* is negative in both panels and always significant at better than the 1% level. Also strongly significant is the coefficient of the interactive *short*IO* term, which is always positive as expected.

The standardized approach in Panel B makes it easier to interpret these results. For example, in Panel B, the coefficient of short interest in the CAR equation (column (3)) is –0.659 percent (t-value = –10.61). This indicates *short*'s predictive power for the lowest *IO* decile. Using the interaction term *short*IO*, we can infer that the predictive power of short for the highest *IO* decile is close to zero and positive (-0.659 + 0.886 = +0.227 percent). A similar result is obtained when SUE is used instead of CAR as dependent variable (columns (1) and (2)).

Overall, the results obtained from Fama-McBeth regressions in Tables 4 and 5 confirm the conclusions from the earlier portfolio sorts: the predictive power of short interest for future earnings surprises is a decreasing function of institutional ownership. These results once again strengthen the conjecture that short sellers' informativeness explains the stock price declines.

B. <u>Short interest as a predictor of changes in analyst forecast</u>

Short sellers are not the only market agents who can predict changes in firm fundamentals. Studies show that sell-side analysts are also able to do so, by accurately forecasting the direction of future earning changes. We examine if short sellers' private information is superior to that of sell-side analysts. This would be the case if short sellers could in fact *predict* changes in earnings forecast. The SEC's assertion would once again be refuted if short sellers were found to detect changes in fundamental values *before* analysts do.

We examine the relation between current levels of short interest and two measures of earning forecast changes. The first, *ΔEPS*, is the one-month-ahead change in the consensus EPS forecast. The second, *%Up-Down*, is the difference between the percentage of analysts who raise their EPS forecast and those who lower it. This difference is measured one month after the short interest is observed.

B.1. Portfolio sorts

Table 6 presents the results obtained using the calendar time portfolio method. Panel A of Table 6 presents prima-facie evidence that short sellers' information is superior to that of sell-side analysts. Stocks with the highest levels of short interest (Short5) are followed by the largest declines in earning forecasts, for both the *ΔEPS* and *%Up-Down* measures.

In Panel B we repeat the analysis after conditioning on firm size, which proxies for the supply of lendable shares. At the bottom of Panel B we measure shorts' predictive power for each *Size* quintile as the difference in *ΔEPS* between the lowest and highest *Short* quintile. The magnitude of that difference is highest for firms in the smallest size quintile (4.740, t=4.93), suggesting that predictability to be stronger for smaller firms where shorts are more likely to be informed. In Panel C of Table 6 we repeat the analysis of Panel B using *IO* instead of *Size* as a proxy for the supply of lendable shares. The results are almost identical: shorts' predictability is highest for the lowest *IO* quintile where shorts are more informed.

Panels D and E repeat the analysis in Panels B and C using *%Up-Down* instead of *ΔEPS* as a measure for changes in earning forecast. Again, the results are unchanged. The difference presented at the bottom of both panels is largest for stocks that are difficult to short, either because they have low *Size* (Panel D), or low *IO* (Panel E). Moreover, this difference is monotonically decreasing as we move towards higher *Size* or *IO* quartiles where shorts become increasingly less informative.

B.2. Fama-MacBeth regressions

For robustness we repeat the analysis in Table 6 using Fama-MacBeth regressions rather than calendar-time portfolio sorts. The results are presented in Table 7. The table follows the same format as Tables 4 and 5. In Panel A we use the continuous values of the independent variables and in Panel B we use decile-based standardized values. As before, we use two independent variables as proxies for changes in earning forecast: *ΔEPS* (in columns (1) and (2)) and *%Up-Down* (in columns (3) and (4)).

The results provide strong evidence that short sellers predict changes in earning forecast: the coefficient of *Short* is significantly negative in both panels and all specifications. We also find strong support for our earlier conclusion that predictability is stronger for stocks with lower supply of shortable shares where shorts are more informed: the coefficient of the interaction term *Short*IO* is always significantly positive.

Once again, our empirical results appear to refute SEC's assertion that shorting contributes to stock price declines. Instead we show that short sellers are able to identify value-relevant information and do so *ahead* of sell-side analysts.

C. Changes in short interest and contemporaneous returns

Our last test examines the relation between returns and contemporaneous changes in short interest. If short selling contributes to price declines, this relation should be negative. The market microstructure literature documents a positive relation between returns and the direction of the contemporaneous order flow, suggesting that market prices appear to move in the direction of the trade. Since shorting contributes to making the orderflow negative, we would expect returns to be lower for stocks with the highest contemporaneous increase in short interest.

Table 8 presents the results. In Panel A, stocks are sorted into quintiles based on the change in short interest from month t to month t+1. For each quintile, we report the contemporaneous raw and abnormal returns during month t+1 (denoted *Ret* and α, respectively). Contrary to SEC's conjecture, we observe that stocks with increases in short interest (*ΔShort5*) are experiencing *positive* contemporaneous abnormal returns (α = 1.50% per month, p<0.01). This suggests that short sellers take positions in stocks they perceived to be overvalued. At the other extreme, stocks with declines in short interest (*ΔShort1*) are declining in value (α = –0.81% per month, p<0.01). Moreover, the difference between the returns of the two groups is positive and highly significant (α = 2.31% per month, p<0.01). The results obtained with raw returns (*Ret*) portray a similar picture.

It may be argued that although the price impact of shorting is not universally negative, it may still be negative for those stocks that are already heavily shorted. It is possible that for these stocks, additional shorts could result in a disproportionately higher price impact of trade, causing a price decline. This would provide marginal support for SEC's assertion that shorting contributes to price declines, but only for stocks that already heavily shorted.

We test this hypothesis in Panels B and C of Table 8. In each panel we first sort stocks into quintiles based on the level of short interest. Within each quintile we further sort stocks according to the change in short interest from month *t* to month *t+1*. In each of the 25 cells we show raw returns (Panel B) and abnormal returns (Panel C). We find no support for SEC's assertion. Short selling does not appear to contribute to price decline, even in the case of the most heavily shorted stocks, where the price impact of a short is likely to be the most significant.

III. Discussion

Short interest predicts stock returns in the cross-section because short sellers are informed traders who generate value-relevant information. Short sellers correctly anticipate negative earning surprises, unfavorable public news, and downgrades in analyst earning forecast. Their trading pattern is consistent with them anticipating the direction of future news, and their trades do not appear to contribute to price declines. Quite to the contrary, we find that stock prices actually appreciate when short sellers increase their positions.

Taken together, these results provide *prima facie* evidence against SEC's hypothesis that shorts contribute to price declines in the stock market. An important caveat, however, is in order. Our results are obtained from a quiescent market period (1988-2005) characterized by low volatility and relatively high liquidity. Since the collapse of Lehman Brothers on September 16, 2008, we have seen unparalleled levels of market volatility, associated with a sharp decline in the level of stock prices. It is theoretically possible that shorting could cause stock price declines when liquidity dries out, particularly in the case of financial institutions which may be affected by contagion.

Thus, while we find no supporting evidence for SEC's hypothesis that shorting contributes to price declines, we cannot rule it out altogether. We leave it as an important topic for future research to determine if the price impact of shorts varies across industries or liquidity regimes.

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Table 1. Short interest, institutional ownership, and future returns

The sample contains common stocks listed on the NYSE, Amex, and Nasdaq during the period from January 1988 to December 2005. Each month, we sort stocks into short interest deciles based on *Short*, the ratio of short interest to shares outstanding. **Panel A** shows the time-series means of firm characteristics, holding-period raw returns (*Ret*), and abnormal monthly returns (α) computed as the intercept from a four-factor model including *mktrf*, *smb*, *hml*, and *umd*. All returns are measured over a one month horizon, during the month following portfolio formation. *IO* is the percentage of shares owned by institutions as reported in 13F filings. *Size* is the market value of equity and defined as share price times the number of shares outstanding. *BM* is the book value of equity divided by the market value of equity calculated at least three months before the short interest data. In **Panel B**, stocks in the highest short interest decile are further sorted into three groups based on the level of institutional ownership. For each group, we show raw returns, abnormal returns, institutional ownership, level of short interest, a count of future news items (*NEWS*), as well as two measures of earning surprises: *SUE* and *CAR*. *NEWS* is the sum of positive-content news items minus the sum of negative-content news items during the month following portfolio formation. We infer news content from the sign of the cumulative abnormal return (CAR) measured around the news date [-2, +1]. To filter out noise associated with daily price movements, we classify small CARs as neutral. We use two different filters: *NEWS1* classifies |CAR|<=0.5% as neutral, while *NEWS2* classifies items with |CAR|<=1% as neutral. Then we assign numerical values of +1 to all positive news items, zero to all neutral items, and –1 to all negative news items and compute a monthly aggregate news measure by averaging the (signed) values of all news items that month. Months with no news items are assigned an aggregate news measure equal to zero. *SUE* is the change in earnings per share from quarter *q*-4 to quarter *q* divided by the standard deviation of unexpected earnings over the last eight quarters. *CAR* is the average market adjusted abnormal return (in percent) during the [-2, +1] window around the earnings announcement date. T-statistics are shown in italics and are based on robust standard errors. *, **, and *** denote significance level at the 10%, 5%, and 1% level, respectively.

Panel A: Sorts on short interest

	Short	IO	Size	BM	Ret	α
Short1 (low)	0.004	12.79	66.63	1.09	1.99***	1.20***
	0.025	16.62	122.93	0.96	1.77***	0.97***
	0.090	20.78	730.98	0.91	1.76***	0.85***
	0.214	26.18	1,313.95	0.85	1.71***	0.77***
	0.402	31.85	2,102.61	0.78	1.46***	0.52***
	0.665	37.52	3,189.79	0.70	1.38***	0.39**
	1.052	42.40	3,065.11	0.67	1.14***	0.10
	1.685	45.91	2,465.56	0.65	1.09***	0.03
	2.968	46.82	1,792.51	0.69	0.77*	-0.23
Short10 (high)	8.823	49.03	1,025.90	0.79	0.48	-0.52***
Short1 – Short10					1.51***	1.72***
t-value					*4.36*	*8.14*

Table 1 (continued)

Panel B: Sorts on institutional ownership for the most shorted decile

	(1)	(2)	(3)	(4)
	IO	**Short**	**Ret**	**α**
IO1 (low)	19.09	8.62	-0.28	-1.00**
	49.53	8.48	0.67	-0.31**
IO3 (high)	78.39	9.36	1.04**	-0.24
3 – 1	59.30	0.74	1.32***	0.76*
t-value			*2.71*	*1.84*

Table 2. Short interest as predictor of public news: a portfolio approach

The sample contains common stocks listed on the NYSE, Amex, and Nasdaq during the period from January 1988 to December 2000. We also require that each stock be included in Chan's (2003) news database. Each month, we sort stocks into short interest deciles based on *Short* (**Panel A**). We also sort stocks, independently, into *Short* and *IO* (**Panel B**), and again into *Short* and *Size* (**Panel C**). *Short* is the ratio of short interest to shares outstanding. *IO* is the percentage of shares owned by institutions as reported in 13F filings. *Size* is the market value of equity and defined as share price times the number of shares outstanding. The table shows the average signed count of public news items (*NEWS*) collected during the month following the measurement of *Short, IO,* and *Size* (as applicable). We infer news content from the sign of the cumulative abnormal return (CAR) measured around the news date [-2, +1]. To filter out noise associated with daily price movements, we classify small CARs as neutral. We use two different filters: *NEWS1* classifies |CAR|<=0.5% as neutral, while *NEWS2* classifies items with |CAR|<=1% as neutral. Then we assign numerical values of +1 to all positive news items, zero to all neutral items, and –1 to all negative news items and compute a monthly aggregate news measure by averaging the (signed) values of all news items that month. Months with no news items are assigned an aggregate news measure equal to zero. Panel A also shows the average level of short interest for each *Short* decile. T-statistics are shown in italics and are based on robust standard errors. *, **, and *** denote significance level at the 10%, 5%, and 1% level, respectively.

Panel A: Future news count as a function of current short interest

	Short	*NEWS1*	*NEWS2*
Short1(low)	0.002	0.037***	0.043***
	0.017	0.046***	0.042***
	0.051	0.037***	0.045***
	0.116	0.032***	0.043***
	0.231	-0.001	0.024***
	0.409	-0.008	0.016
	0.685	-0.020	0.019
	1.152	-0.012	0.014
	2.182	-0.041***	0.001
Short10(high)	7.462	-0.040***	-0.012
Short10-Short1	7.460	-0.077***	-0.054***
t -value		*-4.33*	*-3.69*

Table 2 (continued)

Panel B: Future news count as a function of short interest and institutional ownership

News Definition		IO1 (low)				IO5 (high)	1-5	t-value
	Short 1	0.045***	0.031***	0.056***	0.021	0.037	0.008	0.34
		0.055***	0.028***	0.032**	0.013	0.024	0.031	1.50
		0.056***	0.024	-0.004	-0.016	-0.053**	0.108	3.47
NEWS1		-0.025	-0.002	0.019	-0.015	-0.037	0.011	0.36
	Short 5	-0.055*	-0.061***	-0.072***	-0.024	-0.023	-0.031	-0.83
	1-5	0.100	0.092	0.128	0.045	0.060		
	t-value	*3.30*	*3.70*	*6.80*	*2.06*	*2.02*		
	Short 1	0.042***	0.036***	0.056***	0.020	0.063***	-0.021	-0.96
		0.059***	0.029***	0.041***	0.041***	0.040***	0.019	1.02
		0.051***	0.044***	0.019*	0.010	-0.006	0.057	2.16
NEWS2		-0.022	0.028**	0.036***	0.026*	0.008	-0.030	-1.15
	Short 5	-0.031	-0.027	-0.036***	0.009	0.018	-0.050	-1.45
	1-5	0.073	0.063	0.092	0.011	0.044		
	t-value	*2.45*	*2.94*	*5.75*	*0.65*	*1.6*		

Panel C: Future news count as a function of short interest and firm size

News Definition		SIZE1 (low)				SIZE5 (high)	1-5	t-value
	Short 1	0.049***	0.042***	0.040***	0.007	-0.059	0.031	0.77
		0.065***	0.032***	0.011	0.029*	-0.024	0.024	1.16
		0.039*	0.037***	0.008	-0.005	-0.092**	0.073	2.44
NEWS1		0.011	0.034	-0.001	0.001	-0.049	0.002	0.08
	Short 5	-0.045	-0.042**	-0.046**	-0.033**	-0.065***	-0.003	-0.08
	1-5	0.064*	0.066***	0.059***	0.026	0.03		
	t-value	1.90	3.26	3.36	1.21	0.62		
	Short 1	0.049***	0.041***	0.039***	0.007	-0.059	0.109	1.69
		0.064***	0.031***	0.011	0.029*	-0.024	0.089	2.31
		0.039*	0.037***	0.007	-0.004	-0.092**	0.131	3.16
NEWS2		0.011	0.034	-0.009	0.001	-0.049	0.061	1.61
	Short 5	-0.045	-0.042**	-0.046**	-0.033**	-0.065***	0.019	0.45
	1-5	0.094***	0.084***	0.085***	0.04	0.005		
	t-value	*2.87*	*3.51*	*4.27*	*1.56*	*0.09*		

Table 3. Short interest as predictor of earnings surprises: a portfolio approach

The sample contains common stocks listed on the NYSE, Amex, and Nasdaq during the period from January 1988 to December 2005. In **Panel A**, we sort stocks into quintiles based on standardized unexpected earnings, (*SUE*), defined as the change in earnings per share from quarter *q*-4 to quarter *q* divided by the standard deviation of unexpected earnings over the last eight quarters. We report time-series means of *SUE* and announcement abnormal returns, CARs, defined as the average (across firms) of the daily market-adjusted cumulative abnormal return (in percent) during the [-2, +1] window around the earnings announcement date. In **Panel B**, we sort on quarter *q* short interest (*Short*) and report the time-series average of SUE and CAR. *Short* is the ratio of short interest to shares outstanding. In **Panels C and D** we conduct an independent double sort, first on quarter *q* institutional ownership (IO) and then on quarter *q* short interest (*Short)*. *IO* is the percentage of shares owned by institutions as reported in 13F filings. **Panel C** reports the average SUE for the next-quarter earnings announcement, and **Panel D** reports the corresponding CAR. In **Panels E and F** we conduct an independent double sort, first on quarter *q* firm *size* and then on quarter *q* short interest (*Short)*. *Size* is the market value of equity and defined as share price times the number of shares outstanding. **Panel E** reports the average SUE for the next-quarter earnings announcement, and **Panel F** reports the corresponding CAR. T-statistics are shown in italics and are based on robust standard errors. *, **, and *** denote significance level at the 10%, 5%, and 1% level, respectively.

Panel A: Descriptive statistics on earning surprises

	SUE 1 (low)				SUE 5 (high)
SUE	-2.00	-0.22	0.14	0.60	2.19
CAR	-0.43	-0.19	0.22	0.42	0.53

Panel B: Future earnings surprises as a function of current short interest

	Short1 (low)	Short2	Short3	Short4	Short5 (high)	1 – 5	t-value
SUE	0.14***	0.14***	0.21***	0.19***	0.05	0.09	*1.94*
CAR	0.29***	0.16***	0.07**	0.03**	-0.02	0.31	*4.79*

Panel C: Future SUE as a function of current short interest and institutional ownership

	IO1 (low)				IO5 (high)	1 – 5	t-value
Short 1	0.14***	0.11***	0.08***	0.15***	0.24**	-0.07	*-0.69*
	0.12***	0.09***	0.07*	0.18***	0.32***	-0.20	*-3.34*
	0.09***	0.08**	0.12***	0.23***	0.32***	-0.23	*-4.10*
	0.11**	0.02	0.08*	0.18***	0.34***	-0.23	*-3.85*
Short 5	-0.10**	-0.11**	-0.16***	-0.01	0.25***	-0.35	*-4.71*
1 – 5	0.24	0.22	0.24	0.16	-0.01		
t-value	*4.59*	*4.84*	*3.89*	*2.36*	*-0.53*		

Table 3 (continued)

Panel D: Future earning-event CARs a function of current short interest and institutional ownership

	IO1 (low)				IO5 (high)	1 – 5	t-value
Short 1	0.47***	0.31***	0.21***	0.15***	0.12	0.35	*3.21*
	0.33***	0.18***	0.13***	0.14***	0.06*	0.27	*5.55*
	0.27***	0.13***	0.05**	0.06***	0.07**	0.20	*2.77*
	0.02	0.05	0.01	0.02	0.07**	-0.05	*-0.56*
Short 5	-0.23**	-0.18***	-0.09**	-0.01	0.08**	-0.31	*-3.62*
1 - 5	0.70	0.49	0.29	0.16	0.04		
t-value	*7.13*	*5.21*	*3.57*	*2.17*	*0.35*		

Panel E: Future SUE as a function of current short interest and size

	Size1 (low)				Size5 (high)	1 – 5	t-value
Short 1	0.05*	0.13***	0.29***	0.33***	0.40**	-0.35	*-4.72*
	-0.04	0.01	0.16***	0.33***	0.57***	-0.61	*-8.98*
	-0.06*	-0.08**	0.08**	0.27***	0.49***	-0.55	*-9.14*
	-0.08*	-0.10**	-0.02	0.17***	0.42***	-0.50	*-8.01*
Short 5	-0.21***	-0.27***	-0.20***	0.02	0.31***	-0.52	*-12.40*
1 – 5	0.26	0.40	0.49	0.31	0.09		
t-value	*6.29*	*8.41*	*9.58*	*4.46*	*1.48*		

Panel F: Future earning-event CARs a function of current short interest and size

	Size1 (low)				Size5 (high)	1 – 5	t-value
***Short* 1**	0.53***	0.23***	0.07*	0.07	0.03	0.50	*7.08*
	0.47***	0.16***	0.09***	0.03	-0.03	0.50	*7.12*
	0.39***	0.13***	0.06**	0.03	0.01	0.38	*4.45*
	0.19*	0.10**	-0.01	0.05**	0.01	0.18	*1.64*
***Short* 5**	0.14	-0.13**	-0.12***	-0.02	0.06**	0.08	*0.54*
1 - 5	0.39	0.36	0.19	0.09	-0.03		
t-value	*2.60*	*5.61*	*3.98*	*1.54*	*-0.62*		

Table 4. Short interest as predictor of public news: A regression approach

The sample contains common stocks listed on the NYSE, Amex, and Nasdaq during the period from January 1988 to December 2000. We also require that each stock be included in Chan's (2003) news database. The table shows monthly Fama-Macbeth regressions where the dependent variable is a signed count of lagged monthly news items (*NEWS*). We infer news content from the sign of the cumulative abnormal return (CAR) measured around the news date [-2, +1]. To filter out noise associated with daily price movements, we classify small CARs as neutral. We use two different filters: *NEWS1* classifies |CAR|<=0.5% as neutral, while *NEWS2* classifies items with |CAR|<=1% as neutral. Then we assign numerical values of +1 to all positive news items, zero to all neutral items, and –1 to all negative news items and compute a monthly aggregate news measure by averaging the (signed) values of all news items that month. Months with no news items are assigned an aggregate news measure equal to zero. The independent variables are *Short* (the ratio of short interest to shares outstanding), *IO* (the percentage of shares owned by institutions as reported in 13F filings), *Size* (the natural logarithm of the market value of equity), *BM* (the natural logarithm of the ratio between book value of equity and the market value of equity calculated at least three months before the short interest data) and *MOM* (the mean stock return performance over the previous 12 months). **Panel A** shows results using the actual values of independent variables. In **Panel B** we transform all independent variables into decile ranks and standardize them to take values between zero and one. In both panels, the table reports time-series averages of the coefficient estimates. T-statistics are shown in italics and are based on robust standard errors. *, **, and *** denote significance level at the 10%, 5%, and 1% level, respectively.

Panel A: Regressions based on actual values of the independent variables

	(1)	(2)	(3)	(4)
	NEWS1	***NEWS1***	***NEWS2***	***NEWS2***
Intercept	0.4527	0.3931	0.2668	0.2236
	3.88	*3.73*	*3.27*	*2.98*
SIZE	-0.0254	-0.0213	-0.0137	-0.0108
	-3.65	*-3.46*	*-2.88*	*-2.50*
BM	-0.0167	-0.0133	-0.0082	-0.0061
	-2.35	*-1.90*	*-1.36*	*-1.01*
MOM	0.4016	0.4200	0.3180	0.3335
	4.18	*4.22*	*3.87*	*3.94*
Short	-0.8665	-0.4156	-0.9428	-0.4124
	-2.37	*-2.24*	*-3.45*	*-2.46*
IO	0.0465		0.0302	
	2.25		*2.27*	
Short * IO	0.8588		1.229	
	1.11		*2.15*	
R^2	2.46%	1.99%	1.94%	1.52%

Table 4 (continued)

Panel B: Regressions based on standardized values of the independent variables

	(1)	(2)	(3)	(4)
	NEWS1	***NEWS1***	***NEWS2***	***NEWS2***
Intercept	0.0865	0.0795	0.0649	0.0577
	4.30	*3.87*	*3.88*	*3.31*
SIZE	-0.1656	-0.1203	-0.083	-0.0542
	-3.59	*-2.89*	*-2.53*	*-1.77*
BM	-0.0588	-0.0452	-0.0283	-0.0212
	-2.77	*-2.19*	*-1.59*	*-1.20*
MOM	0.0631	0.0648	0.0472	0.0479
	4.37	*4.40*	*4.15*	*4.13*
Short	-0.0713	-0.0531	-0.0622	-0.0408
	-2.86	*-3.63*	*-2.66*	*-3.26*
IO	0.0464		0.0201	
	2.57		*1.29*	
Short * IO	0.0293		0.0407	
	0.83		*1.22*	
R^2	2.15%	1.76%	1.65%	1.32%

Table 5. Short interest as predictor of earnings surprises: A regression approach

The sample contains common stocks listed on the NYSE, Amex, and Nasdaq during the period from January 1988 to December 2005. We estimate quarterly Fama-Macbeth regressions using earnings surprises as the dependent variable. Earnings surprises are measured using either SUE or CAR. *SUE* is the change in quarterly earnings per share from quarter *q*-4 to quarter *q*, divided by the standard deviation of unexpected earnings over the last eight quarters. *CAR* is the average market-adjusted abnormal return during a [-2, +1] window around the earnings announcement date. The independent variables are *Short* (the ratio of short interest to shares outstanding), *IO* (the percentage of shares owned by institutions as reported in 13F filings), *Size* (the natural logarithm of the market value of equity), *BM* (the natural logarithm of the ratio between book value of equity and the market value of equity calculated at least three months before the short interest data) and *MOM* (the mean stock return performance over the previous 12 months). **Panel A** shows results using the actual values of independent variables. In **Panel B** we transform all independent variables into decile ranks and standardize them to take values between zero and one. In both panels, the table reports time-series averages of the coefficient estimates. T-statistics are shown in italics and are based on robust standard errors. *, **, and *** denote significance level at the 10%, 5%, and 1% level, respectively.

Panel A: Regressions based on actual values of the independent variables

	(1)	(2)	(3)	(4)
	SUE	***SUE***	***CAR***	***CAR***
Intercept	-0.296	-0.333	0.946	0.855
	-3.04	*-2.77*	*11.31*	*9.99*
Size	0.028	0.031	-0.067	-0.057
	3.08	*2.74*	*-9.49*	*-7.98*
BM	-0.207	-0.201	0.044	0.052
	-10.17	*-10.12*	*2.97*	*3.54*
MOM	6.467	6.616	0.728	0.855
	21.23	*21.14*	*2.64*	*3.05*
Short	-0.056	-0.025	-0.043	-0.014
	-9.49	*-7.55*	*-10.62*	*-4.95*
IO	-0.005		0.065	
	-0.09		*1.59*	
Short*IO	0.064		0.054	
	5.91		*8.47*	
R^2	6.82%	6.52%	0.93%	0.82%

<u>Table 5 (continued)</u>

Panel B: Regressions based on standardized values of the independent variables

	(1)	(2)	(3)	(4)
	SUE	***SUE***	***CAR***	***CAR***
Intercept	0.113	-0.046	0.455	0.253
	4.83	*-1.64*	*9.17*	*5.15*
Size	0.157	0.230	-0.402	-0.329
	1.82	*2.42*	*-6.31*	*-5.05*
BM	-0.695	-0.678	0.110	0.131
	-11.73	*-12.20*	*2.55*	*3.05*
MOM	0.992	0.993	0.111	0.121
	17.50	*17.72*	*3.48*	*3.74*
Short	-0.547	-0.372	-0.659	-0.163
	-8.75	*-7.69*	*-10.61*	*-4.63*
IO	-0.062		-0.337	
	-1.02		*-5.79*	
Short*IO	0.314		0.886	
	5.28		*11.09*	
R^2	8.13%	7.91%	1.05%	0.81%

Table 6. Short interest as predictor of changes in analysts' earnings forecasts: A portfolio approach

The sample contains common stocks listed on the NYSE, Amex, and Nasdaq that are available in the First Call database with at least three analyst following during the period from January 1991 to December 2005. *Short* is the ratio of short interest to shares outstanding in percentage terms. *Ret* is the one-month ahead raw return, and *IO* is the percentage of shares owned by institutions as reported in 13F filings. *ΔEPS* is the one-month ahead change in the consensus EPS forecast of analysts in cents. *%Up-Down* is the percentage of analysts who raise their forecasts less the percentage of analysts who lower their forecasts one month after short interest is observed. In **Panel A**, we sort stocks based on short interest (*Short*), and report future firm performance. In **Panel B and D (C and E)**, each month, we sort stocks first on *Size* (*IO*) and then on short interest (*Short)*. **Panels B and C** report the one-month ahead average change in analysts' earnings per share forecasts (*ΔEPS)* for the next fiscal year-end. **Panels D and E** report the difference between the percentage of analysts who lower their EPS forecasts and the percentage of analysts who raise their EPS forecasts one month after short interest is observed. T-statistics are shown in italics and are based on robust standard errors. *, **, and *** denote significance level at the 10%, 5%, and 1% level, respectively.

Panel A: Future performance as a function of current short interest

	Short	***IO***	***Ret***	***ΔEPS***	**%Up-Down**
***Short* 1**	0.30***	45.52***	1.76***	-1.54***	-3.47***
	0.85***	55.48***	1.40***	-1.71***	-3.79***
	1.56***	58.99***	1.44***	-2.18***	-3.75***
	2.86***	60.59***	1.25***	-3.65***	-4.82***
***Short* 5**	8.56***	63.31***	0.89	-4.02***	-4.91***
5 – 1	8.24	17.79	-0.87	-2.48	-1.44
t-value	*23.33*	*16.28*	*-2.80*	*-6.30*	*-2.10*

Panel B: Future changes in analysts' EPS forecasts (ΔEPS) as a function of current short interest and firm size

	Size1 (low)				**Size5 (high)**	**1 – 5**	**t-value**
***Short* 1**	-2.667***	-1.481***	-1.052***	-1.136***	-0.760***	-1.907	*-5.72*
	-1.960	-1.664***	-1.455***	-1.221***	-0.860***	-1.100	*-0.92*
	-3.049***	-2.894***	-2.220***	-1.383***	-0.875***	-2.174	*-3.78*
	-7.738***	-7.188	-2.419***	-3.115***	-1.290***	-6.448	*-2.55*
***Short* 5**	-7.407***	-4.331***	-2.388***	-2.464***	-2.563**	-4.844	*-3.33*
1 – 5	4.740	2.850	1.336	1.328	1.803		
t-value	*4.93*	*7.48*	*4.27*	*2.62*	*1.52*		

Table 6 (continued)

Panel C: Future changes in analysts' EPS forecasts (ΔEPS) as a function of current short interest and institutional ownership (IO)

	IO1 (low)				IO5 (high)	1 – 5	t-value
***Short* 1**	-1.523***	-1.757***	-1.912***	-1.343***	-1.964***	0.441	*-1.25*
	-0.798	-1.714***	-1.991***	-1.285***	-1.542***	0.744	*-0.63*
	-2.066***	-4.103*	-1.781***	-2.186***	-1.757***	-0.309	*-0.80*
	-2.379***	-2.256**	-2.590***	-2.853***	-2.231***	-0.148	*-0.19*
***Short* 5**	-10.707**	-5.580***	-3.605***	-3.489***	-2.227***	-8.480	*-1.99*
1 - 5	9.184	3.823	1.693	2.146	0.263		
t-value	*2.15*	*3.36*	*4.45*	*7.77*	*0.60*		

Panel D: Future analyst behavior (%Up-Down) as a function of current short interest and firm size

	Size1 (low)				Size5 (high)	1 – 5	t-value
***Short* 1**	-6.47***	-1.39	0.21	-0.76	-1.51	-4.96	*-3.88*
	-9.26***	-3.84***	-2.01*	-2.06*	-1.56	-7.70	*-8.12*
	-11.23***	-5.21***	-3.74***	-2.67**	-1.19	-10.04	*-9.61*
	-14.22***	-6.17***	-3.83***	-3.33***	-1.17	-13.05	*-11.63*
***Short* 5**	-15.76***	-6.95***	-0.57	0.07	0.93	-16.69	*-16.45*
1 – 5	9.29	5.56	0.78	-0.83	-2.44		
t-value	*9.34*	*4.38*	*0.71*	*-0.67*	*-2.38*		

Panel E: Future analyst behavior (%Up-Down) as a function of current short interest and institutional ownership (IO)

	IO1 (low)				IO5 (high)	1 – 5	t-value
***Short* 1**	-2.69***	-3.71***	-4.28***	-3.08**	-0.82	-1.87	*-1.39*
	-4.55***	-4.93***	-4.56***	-2.84**	-1.49	-3.06	*-3.14*
	-4.59***	-4.32***	-4.55***	-4.40***	-1.37	-3.22	*-3.03*
	-6.61***	-5.56***	-4.94**	-5.19***	-2.25*	-4.36	*-3.85*
***Short* 5**	-8.33***	-7.75***	-6.34***	-4.71***	0.17	-8.50	*-6.46*
1 - 5	5.64	4.04	2.06	1.63	-0.99		
t-value	*4.88*	*3.81*	*2.02*	*1.44*	*-0.73*		

Table 7. Short interest as predictor of changes in analysts' earnings forecasts: A regression approach

The sample contains common stocks listed on the NYSE, Amex, and Nasdaq during the period from January 1991 to December 2005. We estimate monthly Fama-Macbeth regressions using future changes in analysts' earnings forecasts as the dependent variable. Future changes in earnings forecasts (*ΔEPS*) are measured as the one-month ahead change in consensus earnings forecasts among analysts following a firm reported in cents. *%Up-Down* is the percentage of analysts who raise their forecasts less the percentage of analysts who lower their forecasts one month after short interest is observed. The independent variables are *Short* (the ratio of short interest to shares outstanding), *IO* (the percentage of shares owned by institutions as reported in 13F filings), *Size* (the natural logarithm of the market value of equity), *BM* (the natural logarithm of the ratio between book value of equity and the market value of equity calculated at least three months before the short interest data) and *MOM* (the mean stock return performance over the previous 12 months). **Panel A** shows results using the actual values of independent variables. In **Panel B**, we transform all independent variables into decile ranks and standardize them to take values between zero and one. In both panels, the table reports time-series averages of the coefficient estimates. T-statistics are shown in italics and are based on robust standard errors.

Panel A: Regressions based on actual values of the independent variables

	(1)	(2)	(3)	(4)
	ΔEPS	***ΔEPS***	***%Up-Down***	***%Up-Down***
Intercept	-7.720	-6.759	-18.681	-17.749
	-3.93	*-3.30*	*-6.53*	*-6.01*
Size	0.335	0.330	0.715	0.709
	2.38	*2.59*	*3.08*	*3.33*
BM	-0.890	-0.877	-2.346	-2.404
	-3.48	*-3.73*	*-6.28*	*6.63*
MOM	0.553	0.527	2.703	2.704
	6.63	*7.16*	*15.87*	*16.26*
Short	-0.269	-0.812	-0.145	-0.477
	-4.41	*-3.48*	*-2.61*	*-3.40*
IO		-1.544		-1.724
		-1.40		*-1.01*
Short*IO		0.928		0.574
		2.92		*2.63*
Avg. R^2	3.49%	3.98%	6.85%	7.27%

Table 7 (continued)

Panel B: Regressions based on standardized values of the independent variables

	(1)	(2)	(3)	(4)
	ΔEPS	*ΔEPS*	*%Up-Down*	*%Up-Down*
Intercept	-5.961	0.277	-24.167	-20.113
	-3.40	*0.11*	*-11.85*	*-8.72*
Size	4.619	4.618	6.634	7.202
	2.76	*3.09*	*3.23*	*3.85*
BM	-3.023	-2.992	-7.711	-7.764
	-3.97	*-4.15*	*-7.13*	*-7.27*
MOM	7.339	6.876	35.741	36.027
	5.57	*7.56*	*24.85*	*25.50*
Short	-4.519	-14.497	-2.811	-7.117
	-6.21	*-2.36*	*-2.86*	*-3.00*
IO		-8.085		-6.307
		-2.35		*-2.14*
Short*IO		13.168		6.031
		1.86		*1.91*
Avg. R^2	3.47%	3.73%	7.81%	8.21%

<u>Table 8. Changes in short interest and contemporaneous returns</u>

The sample contains common stocks listed on the NYSE, Amex, and Nasdaq during the period from January 1988 to December 2005. **Panel A** shows characteristics of portfolios sorted on change in short interest (*ΔShort*). Each month, stocks are sorted into five portfolios based on the value of *ΔShort* measured from month *t* to *t+1*. We report short interest (*Short*) in month *t*, *ΔShort*, contemporaneous raw returns (*Ret*) and abnormal returns (α) from month *t* to *t+1*. **Panels B and C** show portfolios first sorted based on short interest (*Short*) in month *t* and then sorted on change in short interest (*ΔShort)* from month *t* to *t+1*. For each portfolio, we report short interest (*Short*) in month *t*, change in short interest (*ΔShort*) from month *t* to *t+1.* In **Panel B** we report contemporaneous raw returns (*Ret*), and in **Panel C** we report abnormal returns (α), all measured from month *t* to *t+1*. Abnormal returns are computed as the intercept from a four-factor model that includes the three Fama-French factors (*mktrf*, *smb*, and *hml*) augmented with the momentum factor (*umd*). T-statistics are shown in italics and are based on robust standard errors. *, **, and *** denote significance level at the 10%, 5%, and 1% level, respectively.

Panel A: Stock returns as a function of contemporaneous changes in short interest

	Short	***ΔShort***	***Ret***	***α***
***ΔShort1* (low)**	3.36^{***}	-0.69^{***}	0.11	-0.81^{***}
	0.81^{***}	-0.06^{***}	0.49	-0.34^{*}
	0.34^{***}	0.00	0.96^{**}	0.26
	0.78^{***}	0.07^{***}	2.56^{***}	1.65^{***}
***ΔShort5* (high)**	2.74^{***}	0.77^{***}	2.69^{***}	1.50^{***}
5-1	-0.62^{***}	1.46^{***}	2.58^{***}	2.31^{***}
t-stat	*-10.6*	*24.41*	*16.59*	*13.17*

Panel B: Raw returns as a function of contemporaneous changes in short interest, conditioned upon the level of short interest

	Raw Return (Ret)				
	***Short 1* (low)**				***Short 5* (high)**
***ΔShort1* (low)**	-0.06	0.22	0.16	0.03	-0.18
	0.69^{**}	0.49	0.44	0.56	0.08
	1.12^{***}	0.93^{**}	1.10^{**}	0.86^{**}	0.70
	2.58^{***}	2.64^{***}	2.09^{***}	1.69^{***}	1.26^{**}
***ΔShort5* (high)**	5.48^{***}	4.44^{***}	3.23^{***}	2.40^{***}	1.29^{**}
5-1	5.54	4.22	3.07	2.37	1.47
t-stat	*20.93*	*14.85*	*14.38*	*11.02*	*7.84*

Table 8 (continued)

Panel C: Abnormal returns as a function of contemporaneous changes in short interest, conditioned upon the level of short interest

	Abnormal Return (α)				
	***Short 1* (low)**				***Short 5* (high)**
***ΔShort1* (low)**	-0.85***	-0.59**	-0.71***	-0.92***	-1.08***
	-0.07	-0.35	-0.37*	-0.41***	-0.84***
	0.43	0.15	0.37	-0.04	-0.12
	1.80***	1.77***	1.09***	0.63***	0.26
***ΔShort5* (high)**	4.54***	3.27***	1.98***	1.17***	0.16
5-1	5.38	3.86	2.69	2.09	1.24
t-stat	*22.17*	*17.07*	*10.08*	*9.79*	*5.21*