THE JOURNAL OF FINANCE • VOL. LXV, NO. 5 • OCTOBER 2010

# Short Sellers and Financial Misconduct

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**ABSTRACT**

We examine whether short sellers detect firms that misrepresent their financial statements, and whether their trading conveys external costs or benefits to other investors. Abnormal short interest increases steadily in the 19 months before the misrepresentation is publicly revealed, particularly when the misconduct is severe. Short selling is associated with a faster time-to-discovery, and it dampens the share price inflation that occurs when firms misstate their earnings. These results indicate that short sellers anticipate the eventual discovery and severity of financial misconduct. They also convey external benefits, helping to uncover misconduct and keeping prices closer to fundamental values.

SHORT SELLING IS A CONTROVERSIAL ACTIVITY. Detractors claim that short sellers undermine investors' confidence in financial markets and decrease market liquidity. For example, a short seller can spread false rumors about a firm in which he has a short position and profit from the resulting decline in the stock price.[1] Advocates, in contrast, argue that short selling facilitates market efficiency and the price discovery process. Investors who identify overpriced firms can sell short, thereby incorporating their unfavorable information into market prices. In his account of short selling in Allied Capital, Inc., hedge fund

*Foster School of Business, University of Washington and Lerner School of Business and Economics, University of Delaware, respectively. We thank especially Jerry Martin, who maintains the Karpoff-Lee-Martin database used in this study, and also Anup Agrawal, Uptal Bhattacharya, Hemang Desai, Karl Diether, Avi Kamara, Adam Kolansinski, Jennifer Koski, Srinivasan Krishnamurthy, Paul Laux, Paul Malatesta, Charu Raheja, Ed Rice, Ronnie Sadka, Mark Soliman, Ingrid Werner, two *Journal of Finance* referees, the Associate Editor, Campbell Harvey, and seminar participants at the 2008 CRSP Forum, Concordia University, Yale Law School, Binghamton University–SUNY, Rutgers University, Syracuse University, Temple University, University of Indiana, University of Washington, Vanderbilt Law School, and the California Corporate Finance Conference for helpful comments. We also thank the Q Group, The CFO Forum, and the Foster School of Business for financial support.

[1]There are many anecdotes about such strategies, which former SEC Chairman Christopher Cox called "distort and short" (see "What the SEC really did on short selling," *The Wall Street Journal*, July 24, 2008, A15). In 2000, for example, investor Mark Jakob turned a $241,000 profit by shorting Emulex stock and spreading an Internet rumor that Emulex's CEO was stepping down amid an SEC investigation (see http://www.sec.gov/litigation/litreleases/lr16747.htm and http://www.sec.gov/litigation/litreleases/lr16857.htm). Leinweber and Madhavan (2001) report a case in which investors shorted Sea World stock and spread false rumors that Shamu, Sea World's main attraction, was ill. For other examples, see Alistair Barr, "Short sellers: The good, the bad and the ugly," MarketWatch, June 13, 2006.

manager David Einhorn argues that short sellers even help uncover financial reporting violations (Einhorn (2008)).[2]

In this paper, we investigate whether short sellers do in fact identify overpriced firms, and whether in the process they convey external benefits or harm upon other investors. To do so, we measure short selling in a set of firms that, ex post, clearly were overpriced: those that are disciplined by the SEC for financial misrepresentation. In our sample of 454 firms from 1988 through 2005, 96% have negative abnormal returns on the days their misconduct was publicly revealed, with an average 1-day stock price decline of 18.2%. These firms therefore provide a natural test of the view that short sellers can anticipate bad news.

The results of three tests indicate that short sellers are proficient at identifying financial misrepresentation before it becomes public. First, abnormal short interest rises significantly in the 19-month period before the misrepresentation is publicly revealed. Second, the amount of short selling is positively related to measures of misconduct severity, indicating that short sellers take larger positions when the misrepresentation is particularly egregious. And third, short interest-based indicators of financial misrepresentation in any given firm-month are significantly related to the actual presence of misrepresentation, as revealed in subsequent SEC documents.

We also investigate whether short selling has external effects on other investors. We do not find evidence that short selling imposes external harm by triggering a cascade of selling when the misconduct is publicly revealed. To the contrary, short selling conveys positive externalities to other investors, in two ways. First, the amount of prior short selling is positively related to how quickly the misconduct is publicly revealed. Our point estimates indicate that, among firms that are 12 months into their misrepresentation, those with abnormal short interest at the $75^{\text{th}}$ percentile will be publicly revealed 8 months before firms at the $25^{\text{th}}$ percentile.

Second, short selling dampens the amount by which prices are inflated while firms report incorrect financial statements. This improves price efficiency and decreases the transfer from uninformed investors who buy shares from insiders or the firm before the misconduct is revealed to the public. We estimate that this price impact translates into savings for uninformed investors of around 1.67% of the firm's market capitalization on average. Some of these savings are captured by short sellers, who earn profits that average 0.58% of equity value. Even net of such profits, the average net external benefit to uninformed investors equals 1.09% of the firm's equity value.[3]

These findings do not address whether short selling *in general* is informed and beneficial for other investors. For example, we cannot rule out the possibility that some short sellers are noise traders, or that some seek to manipulate prices through false rumors. But in our events—in which company managers

[2]Lamont (2004) and Jones and Lamont (2002) summarize the debate over whether short selling fosters market efficiency or facilitates harmful manipulation. See also Wilchins (2008).

[3]These point estimates correspond to our first measure of abnormal short interest, *ABSI*(1). Depending on the specific measure, our point estimates of the net external benefit range from 0.19% to 1.53% of equity value. See Section V.C and Table IX below.

produce falsified financial statements—short sellers play a significant role in identifying, uncovering, and mitigating the effects of financial misconduct.

This paper is organized as follows. In Section I, we review related research and argue that our sample and test design are uniquely well suited to examine whether short sellers anticipate and help uncover financial misconduct. Section II describes our data and measures of abnormal short interest. Section III reports on tests of short sellers' ability to anticipate financial misconduct, and Section IV examines short sellers' external effects on other investors. Section V concludes.

## I. Related Research

Our investigation is related to a large body of research that examines whether short sellers target overvalued stocks.[4] The results are somewhat mixed. Asquith and Meulbroek (1996) and Desai et al. (2002) find that stocks that are highly shorted in one month tend to underperform in the next month, and Diether, Lee, and Werner (2009) find that short sellers appear to take advantage of short-term overreaction in stock prices. Christophe, Ferri, and Angel (2004), Christophe, Ferri, and Hsieh (2009), and Liu, Ma, and Zhang (2008) find that short selling increases before negative earnings announcements, analyst downgrades, and mortgage loss-related write-downs. In contrast, Daske, Richardson, and Tuna (2005) do not find any predictive ability of short selling, and Henry and Koski (2010) find no evidence of informed short selling around SEO announcements.

Our empirical tests employ measures of abnormal short interest that condition on firm characteristics, and thus are related to inquiries into whether short sellers use information about firm fundamentals. Dechow et al. (2001), Asquith et al. (2005), and Duarte, Lou, and Sadka (2006) find that short interest is related to market capitalization, book-to-market, and momentum. Richardson (2003) fails to find evidence that short sellers target firms with high accruals. But Cao, Dhaliwal, and Kolasinski (2006) find that short sellers do target firms with high accruals after controlling for surprises in earnings announcements. We find that short interest is related to accruals, as well as market capitalization, book-to-market, momentum, insider selling, institutional ownership, and share turnover.

Three prior studies are most closely related to ours. Dechow, Sloan, and Sweeney (1996) report an increase in short interest in the 2 months before an SEC release in a sample of 27 Accounting and Auditing Enforcement Releases. Desai, Krishnamurthy, and Venkataraman (2006) and Efendi, Kinney, and Swanson (2006) examine short selling before the accounting restatements in a database compiled by the Government Accountability Office (GAO).[5] Our investigation differs from these papers in several ways. First, we introduce

[4]See Figlewski (1981), Asquith and Meulbroek (1996), Desai et al. (2002), and Asquith, Pathak, and Ritter (2005).

[5]For a description of the GAO restatement data, see http://www.gao.gov/special.pubs/gao-06-1079sp/.

several controls for the severity of the misconduct, allowing us to infer whether short selling affects stock prices directly, or whether it merely serves as a proxy for misconduct severity. Second, we examine whether short selling tends to concentrate in the misconduct firms. And third, we estimate the external effects on uninformed investors—including whether short selling helps expose financial misconduct and whether it dampens price inflation during the violation period. The Internet Appendix contains a tabular summary of the results that are new to this paper.[6]

The data we use also provide for more powerful tests than the GAO restatement data. Hennes, Leone, and Miller (2008) report that 76% of the restatements in the GAO database are simple errors rather than misrepresentation or fraud, a concern also expressed by Files, Swanson, and Tse (2009). This suggests that the GAO database contains a large number of misclassified events. Even when restatements do reflect financial misconduct, they can occur many months after the misconduct is public knowledge. In our sample, SEC inquiries into financial misconduct are resolved 41 months after the initial public revelation, on average. Using a restatement that is made during or after that 41-month period would misclassify when the misrepresentation was or was not public knowledge.

## II. Data and Short Interest Measures

### *A. Financial Misrepresentation Data*

To avoid the data problems discussed above, we use the Karpoff, Lee, and Martin (2008a, 2008b) (hereafter KLM) database to identify all 632 SEC enforcement actions for financial misrepresentation initiated from 1988 through 2005.[7] These data identify the period during which the misrepresentation occurred and also the *trigger event*, which is the initial public revelation of the misconduct. This allows us to focus on short selling around the initial public revelation. Short interest data are available for 474 of the 632 firms, and 454 firms have sufficient data on CRSP to calculate returns on their revelation dates.

To illustrate the nature of our data and tests, it is useful to review the sequence of events that constitute an SEC enforcement action.[8] These events are summarized in Figure 1. Most enforcement actions follow a conspicuous *trigger*

[6]The Internet Appendix is available on *The Journal of Finance* website at http://www.afajof.org/supplements.asp.

[7]Karpoff et al. (2008a, p. 10) report that the database is collected from "... Lexis-Nexis' FEDSEC:SECREL library for information on SEC securities enforcement actions, the FEDSEC:CASES library for information on litigated enforcement actions, and the Academic Business News, General News, and Legal Cases libraries for news releases (frequently issued by defendant firms) about each enforcement action ... the SEC's website at http://www.sec.gov, which contains all SEC public releases relating to enforcement actions since September 19, 1995 ... the Department of Justice itself, which provided ... further data on enforcement outcomes [, and] the Department of Justice's Corporate Fraud Task Force website at http://www.usdoj.gov."

[8]The following two paragraphs follow Section III in Karpoff et al. (2008b).

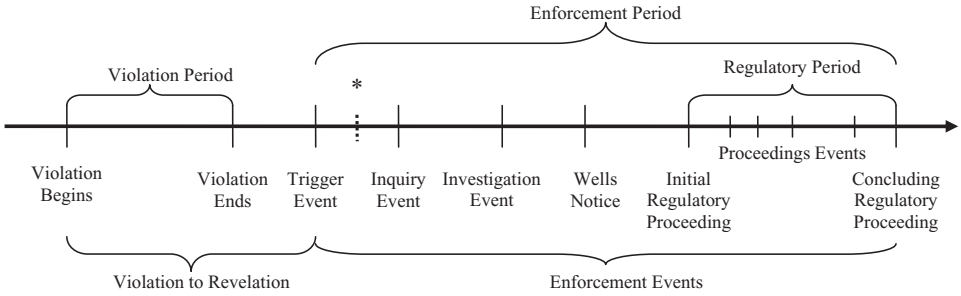


**Figure 1. Timeline of a typical enforcement action.**

*event* that publicizes the potential misconduct and attracts the SEC's scrutiny. Common trigger events include self-disclosures of malfeasance, restatements, auditor departures, and unusual trading. Here are two examples of trigger events from our sample:

1. On November 21, 2000, Lucent Technologies Inc. announced that it had identified a revenue recognition issue in its already-reported fourth quarter report as the company was completing its financial statements for fiscal year 2000. The company also told investors not to rely on its first-quarter forecast of 2001. Share prices fell 16% on the announcement day.
2. On November 13, 2003, Virbac Corporation announced that it was delaying the filing of its third-quarter 2003 Form 10-Q. Share prices fell 22% on the announcement day.

Following a trigger event, the SEC gathers information through an informal inquiry that may develop into a formal investigation of financial misconduct. At this point the SEC may drop the case, in which case it does not appear in our sample. If the SEC proceeds, it typically sends a Wells Notice to prospective defendants, notifying them that it intends to begin enforcement proceedings. It then imposes administrative sanctions and/or seeks redress through civil actions. Some cases are referred to the Department of Justice and lead to criminal charges as well. The SEC releases its findings and penalties in its Administrative Proceedings and Litigation Releases, and every enforcement action in our sample has at least one such release. These releases provide detailed information on the period over which the misrepresentation occurred—which we label the violation period—as well as other information that we use in our empirical tests.

As reported in Table I, the events illustrated in Figure 1 typically take several years to play out. In our sample of enforcement events, the median length of the violation period is 24 months, and the median length from the beginning of the violation until its initial public revelation is 26 months. The period from the initial public revelation until the end of the enforcement action is an additional 41 months. Table I shows that the number of enforcement actions, the median

**Table I**
**Description of the Financial Misrepresentation Sample**

This table describes the yearly distribution of the 632 SEC enforcement actions for financial misrepresentation from 1988 through 2005. The violation period is the date the financial misrepresentation began until it ended, as identified in SEC litigation or administrative releases. The revelation date is the earliest date that information about the misrepresentation was made public. Most revelation dates are identified in SEC releases, and the remaining are identified in the Karpoff et al. (2008a, 2008b) database. Revelation events include firm disclosures, restatements, auditor changes, SEC filing delays, whistle-blower charges, class action lawsuit filings, bankruptcy filings, and SEC actions (informal inquiries, formal investigations, Wells Notices, or first regulatory proceeding).

| | | Violation Period (Months) | | Violation Beginning to Public Revelation (Months) | |
|---|---|---|---|---|---|
| Year | Number of Cases | Mean | Median | Mean | Median |
| 1988 | 25 | 20 | 24 | 31 | 28 |
| 1989 | 13 | 25 | 23 | 30 | 23 |
| 1990 | 28 | 20 | 15 | 29 | 22 |
| 1991 | 34 | 34 | 24 | 35 | 30 |
| 1992 | 35 | 26 | 24 | 32 | 28 |
| 1993 | 32 | 24 | 20 | 31 | 24 |
| 1994 | 46 | 22 | 17 | 29 | 22 |
| 1995 | 29 | 26 | 24 | 28 | 25 |
| 1996 | 37 | 29 | 27 | 33 | 27 |
| 1997 | 34 | 26 | 24 | 32 | 24 |
| 1998 | 36 | 30 | 21 | 33 | 25 |
| 1999 | 36 | 33 | 30 | 33 | 24 |
| 2000 | 67 | 27 | 24 | 28 | 23 |
| 2001 | 49 | 26 | 21 | 25 | 20 |
| 2002 | 70 | 32 | 24 | 33 | 27 |
| 2003 | 31 | 32 | 33 | 35 | 29 |
| 2004 | 17 | 32 | 32 | 41 | 36 |
| 2005 | 13 | 42 | 36 | 46 | 36 |
| Total | 632 | 28 | 24 | 31 | 26 |

violation period, and median period from the beginning of the violation to its public revelation generally increased from 1988 to 2005.

Panel A of Table II reports that news about financial misrepresentation is associated with large declines in stock price. Return data are available for 454 of our sample firms. For 359 of these firms, the trigger event reported in the KLM database is identified in the SEC's administrative and litigation releases. The mean 1-day market-adjusted return on the SEC-identified trigger date is −20.7%, and the median is −15.0%.

For 95 of our events the SEC identified no trigger date, or the KLM database indicates that there was an earlier public revelation of the misconduct. In 37 of our events, for example, the start of a class action lawsuit is the earliest public revelation of the misconduct. The mean 1-day market-adjusted return

**Table II**
## Share Price Reactions to Announcements of Financial Misrepresentation

This table presents summary statistics on the 1-day market-adjusted returns for key dates in the sample of 454 SEC enforcement actions for financial misrepresentation from 1988 to 2005, for which sufficient returns data are available on CRSP. The market-adjusted return is the firm's return minus the CRSP value-weighted return on the same day. Panel A reports market-adjusted returns for the revelation date, which is the earliest date that information about the misrepresentation was revealed to the public. Most (359) revelation dates are identified by the SEC, and include firm disclosures, restatements, auditor changes, SEC filing delays, and whistle-blower charges. In 95 cases, the initial revelation date is identified in the Karpoff et al. (2008a, 2008b) database. These events include announcements of an SEC informal inquiry or formal investigation, announcements of a Wells Notice, the initiation of regulatory proceedings, class action lawsuits, and bankruptcy announcements. Panel B reports on important announcements about the misrepresentation that were made after the public revelation date. These subsequent events include announcements of an informal SEC inquiry, formal SEC investigation, Wells Notice, initiation of regulatory proceedings, initiation of class action lawsuits, and bankruptcy. There are a total of 844 such subsequent announcements. Of these, 371 are follow-ups to the initial revelation date. Of these 371 cases, 274 have a third announcement, 147 have a fourth announcement, and 46 have a fifth announcement.

| | *N* | Mean (%) | Median (%) | *t*-Stat |
|---|---|---|---|---|
| Panel A: Initial Public Revelation Date | | | | |
| All initial revelation dates | 454 | −18.20 | −11.10 | −19.90 |
| SEC-identified trigger event | 359 | −20.70 | −15.00 | −19.00 |
| Other initial revelation events | 95 | −8.90 | −5.77 | −8.55 |
| –SEC informal inquiry | 15 | −12.10 | −11.70 | −5.17 |
| –SEC formal investigation | 22 | −9.32 | −6.09 | −4.62 |
| –SEC Wells Notice | 1 | −1.03 | −1.03 | N/A |
| –Regulatory proceedings begin | 12 | −6.29 | −1.97 | −2.98 |
| –Class action lawsuits begin | 37 | −5.93 | −3.73 | −5.12 |
| –Bankruptcy | 8 | −20.40 | −14.40 | −3.00 |
| Panel B: Important Subsequent Announcements | | | | |
| 2nd announcement | 371 | −9.61 | −4.96 | −12.41 |
| 3rd announcement | 274 | −7.22 | −3.97 | −8.85 |
| 4th announcement | 147 | −3.52 | −1.95 | −4.88 |
| 5th announcement | 46 | −0.00 | −0.90 | 0 |
| 6th or higher announcement | 6 | −13.76 | −6.09 | −1.53 |
| All subsequent announcements combined | 844 | −7.28 | −3.69 | −15.30 |

for these 37 cases is −5.93%. Other less common revelation dates include the announcement of a formal SEC investigation (22 events), an informal SEC inquiry (15), the initial regulatory action and SEC release (12), and bankruptcy filing (8). For all 95 of the revelation dates that are not identified by the SEC, the mean 1-day market-adjusted return is −8.9%.

Averaging over all 454 initial revelation dates, the mean abnormal return is −18.2% and the median is −11.1%. In the tests that follow we use data from all 454 events. The results are qualitatively identical, however, if we

limit the sample to the 359 events for which the SEC identified the trigger date. Either way, these results indicate that public announcements that firms violated financial reporting rules are associated with large declines in share values. These are exactly the type of events that benefit short sellers.

Panel B of Table II reveals that share prices tend to decrease further when additional news about the misrepresentation is revealed to the public. The announcements in this panel include SEC informal inquiries, SEC formal investigations, Wells Notices, the initiation of regulatory proceedings, the initiation of class action lawsuits, and bankruptcies. A total of 371 of the 454 events have a second announcement. The mean 1-day return for these 371 second announcements is −9.6%. A total of 274 events have a third announcement, with a mean 1-day return of −7.2%. Combining all 844 subsequent announcements in Panel B, the mean 1-day return is −7.3% with a $t$-statistic of −15.3. These numbers indicate that subsequent information about these firms' financial misconduct—even after the initial public revelation—also tends to be unfavorable.

### *B. Short Interest Data and Related Data*

Our tests examine the ability of short sellers to depict misrepresentation before it is publicly revealed, and thus we focus on short interest during the violation period immediately before the initial public revelation dates that are summarized in Panel A of Table II. Monthly short-interest data are obtained from the New York Stock Exchange (NYSE), the American Stock Exchange (Amex), and NASDAQ for the period January 1988 to December 2005.[9] Short interest reflects the open short positions of stocks with settlements on the last business day on or before the 15$^{th}$ of each calendar month. Settlement, however, takes a few days, and for a short sale transaction to be recorded in month $t$, it must occur before or on the trade date. Before June 1995, the trade date was 5 days before the settlement date; currently, it is 3 days before. We define month $t$ as starting the day after the trade date of calendar month $t-1$ and ending on the trade date of calendar month $t$. Raw short interest for firm $i$ in month $t$, $SI_{it}$, is the percent of total shares outstanding in month $t$. The pooled mean level of $SI_{it}$ over all months for all firms covered by the short interest data is 1.65%.

Monthly stock returns and market capitalization are constructed from daily data obtained from CRSP using the month definition explained above. Some of the analysis requires data on past returns and institutional ownership. Consequently, we use CRSP data from January 1987 through December 2005. We obtain data on institutional ownership from the CDA/Spectrum database provided by Thomson Financial. The data, derived from institutional investors'

[9]Daily data from January 1, 2005 through August 6, 2007 recently have become available to researchers. These data, however, cover only a small number of the enforcement actions in our sample. The daily data also do not contain information about short positions that are covered, making it impossible to compute net changes in short interest. The monthly data therefore are well suited to our tests.

quarterly filings of SEC Form 13F, include quarterly holdings for each stock for each quarter between December 1987 and December 2005.

### *C. Abnormal Short Interest*

In addition to raw short interest, we examine three measures of abnormal short interest. For firm $i$ in month $t$, abnormal short interest equals

$$ABSI(j)_{it} = SI_{it} - E(SI(j)_{it}),\ j = 1, 2, 3, \tag{1}$$

where $SI_{it}$ is raw short interest and $E(SI(j)_{it})$ is the expected short interest based upon one of three benchmarks $j$ that reflect the firm's characteristics.

The first benchmark, $E(SI(1)_{it})$, controls for the firm's market capitalization, book-to-market ratio, past stock performance, and industry. These controls reflect findings by Dechow et al. (2001), Asquith et al. (2005), and Duarte et al. (2006) that short interest is related to market capitalization, the book-to-market ratio, and momentum. At the beginning of each month, each stock is assigned to one of 27 portfolios constructed by independently sorting stocks by size, book-to-market, and momentum, all measured at the end of the prior month. Each of the 27 portfolios is further partitioned into industry groups using two-digit SIC codes. We exclude the sample firms in constructing the matching portfolios.

In particular, $E(SI(1)_{it})$ is the fitted value from a cross-sectional regression that is estimated for each month $t$:

$$SI_{it} = \sum_{g=low}^{medium} s_{gt} Size_{igt} + \sum_{g=low}^{medium} b_{gt} BM_{igt} + \sum_{g=low}^{medium} m_{gt} Mom_{igt} + \sum_{k=1}^{K} \phi_{kt} Ind_{ikt} + u_{it}. \tag{2}$$

The first three sets of explanatory variables are dummy variables that jointly define the 27 size-, book-to-market-, and momentum- based portfolios. For example, if firm $i$ is assigned to the portfolio with the lowest market capitalization in month $t$, then $Size_{i,low,t,} = 1$, $Size_{i,medium,t,} = 0$, and $Size_{i,high,t} = 0$. Industry dummy $Ind_{ikt} = 1$ if firm $i$ belongs to industry $k$ in month $t$, and $K$ is the total number of industries. By construction, $\sum_{k=1}^{K} Ind_{ikt} = 1$ (so the intercept term is omitted). Each monthly regression uses all firms listed on NYSE, Amex, or NASDAQ that are not in our SEC enforcement action sample and for which data on short interest, market capitalization, book-to-market, and momentum are available over the period 1988 through 2005.

Table III reports the time-series averages of the coefficient estimates (excluding industry dummies) of the monthly cross-sectional regressions. The associated $t$-statistics are computed with Newey–West (1987) corrections for serial correlation using three lags. The base portfolio in this regression is the portfolio with the highest market capitalization, book-to-market ratio, and momentum for each industry. This means that the coefficients are interpreted as the difference between the short interest of the given portfolio and that of the base portfolio. The results show that the largest firms have the highest short

**Table III**

## Models Used to Calculate Abnormal Short Interest

For each month *t,* short interest (*SI*) is regressed on variables that are likely to explain the level of short interest that is unrelated to short sellers' information about financial misconduct. Short interest (*SI*) is the number of shares shorted as a percentage of the number of shares outstanding. The table reports the time-series means and *t*-statistics of the monthly coefficient estimates. For Model 1:

$$SI_{it} = \sum_{g=low}^{medium} s_{gt} Size_{igt} + \sum_{g=low}^{medium} b_{gt} BM_{igt} + \sum_{g=low}^{medium} m_{gt} Mom_{igt} + \sum_{k=1}^{K} \phi_{kt} Ind_{ikt} + u_{it}.$$

Explanatory variables include size, the book-to-market ratio, and momentum, all measured at the beginning of month *t.* The explanatory variables are dummy variables. For example, if firm $i$ is assigned to the portfolio with the lowest market capitalization in month $t$, then $Size_{i,low,t} = 1$, $Size_{i,medium,t} = 0$, and $Size_{i,high,t} = 0$. Model 2 includes dummy variables for share turnover and institutional ownership, and Model 3 includes continuous variables for total accruals and insider selling. All three regressions include industry dummies with $Ind_{ikt} = 1$ if firm $i$ belongs to industry $k$ in month $t$. Variable $K$ is the total number of industries, and industry is defined using two-digit SIC codes from CRSP. The sample includes all firms listed on NYSE, Amex, or NASDAQ that are not in the SEC enforcement action sample and for which data are available during the 1988 to 2005 period. *t*-statistics are computed with Newey–West (1987) corrections for serial correlation using three lags.

| | Model 1 (Used to Calculate *ABSI*(1)) | Model 2 (Used to Calculate *ABSI*(2)) | Model 3 (Used to Calculate *ABSI*(3)) |
|---|---|---|---|
| $\text{Size}_{\text{low}}$ | −1.952 | −0.709 | −0.813 |
| | [−13.09] | [−8.22] | [−8.32] |
| $\text{Size}_{\text{medium}}$ | −0.922 | −0.322 | −0.395 |
| | [−9.92] | [−4.76] | [−5.02] |
| $\text{BM}_{\text{low}}$ | 0.345 | 0.270 | 0.264 |
| | [7.49] | [6.51] | [6.28] |
| $\text{BM}_{\text{medium}}$ | −0.353 | −0.266 | −0.286 |
| | [−14.12] | [−11.92] | [−12.05] |
| $\text{Momentum}_{\text{low}}$ | 0.402 | 0.454 | 0.466 |
| | [8.16] | [11.07] | [10.30] |
| $\text{Momentum}_{\text{medium}}$ | −0.147 | 0.093 | 0.093 |
| | [−5.48] | [3.64] | [3.59] |
| $\text{Turnover}_{\text{low}}$ | | −2.261 | −2.248 |
| | | [−16.10] | [15.73] |
| $\text{Turnover}_{\text{medium}}$ | | −1.899 | [−1.88] |
| | | [−16.14] | [−15.72] |
| $\text{Institutional ownership}_{\text{low}}$ | | −0.949 | −0.931 |
| | | [−10.46] | [−8.94] |
| $\text{Institutional ownership}_{\text{medium}}$ | | −0.588 | −0.531 |
| | | [−8.38] | [−6.84] |
| Total accruals | | | 0.419 |
| | | | [7.38] |
| Insider selling | | | 3.823 |
| | | | [10.28] |
| Industry controls | Yes | Yes | Yes |
| Adj-$R^2$ | 0.21 | 0.27 | 0.28 |

interest. Both the book-to-market ratio and momentum have U-shaped relations with short interest, as indicated by the different signs of $b_{low}$ and $b_{medium}$, and $m_{low}$ and $m_{medium}$. The relation between the book-to-market ratio and short interest is consistent with the finding in Dechow et al. (2001). The U-shaped relation between short interest and momentum also is documented by Duarte et al. (2006). Stocks with the lowest book-to-market ratios and lowest past performance are most highly shorted.

Our second measure of abnormal short interest, $ABSI(2)_{it}$, includes additional controls for share turnover and institutional ownership, which D'Avolio (2002) shows are related to short sales constraints. The coefficients reported in the second column of Table III indicate that short interest increases with both share turnover and institutional ownership. The fitted values from each monthly cross-sectional regression are used to estimate $E(SI(2)_{it})$, the expected amount of short interest for firm $i$ in month $t$, which is in turn used to calculate $ABSI(2)_{it} = SI_{it} - E(SI(2)_{it})$.

Our third measure of abnormal short interest, $ABSI(3)_{it}$, expands the number of control variables to include total firm accruals and insider selling. Healy (1985), Dechow et al. (2010), and others show that accruals can be used to manipulate earnings, and Agrawal and Cooper (2008) show that insider selling is correlated with financial misconduct at many firms. Einhorn (2008) reports that many short sellers base their positions on accruals and insider selling even in the absence of any specific knowledge about the firm. $ABSI(3)_{it}$ reflects short sellers' information over and above their knowledge about accruals, insider selling, or the other control variables.

Our measure of total accruals for firm $i$ in month $t$ is the same as that used by Richardson et al. (2005):

$$Total\ accruals = \frac{\Delta WC_{it} + \Delta NCO_{it} + \Delta FIN_{it}}{(Assets_{it} + Assets_{i,t-12})/2}. \tag{3}$$

Here, $\Delta WC_{it}$ is firm $i$'s change in noncash working capital. It is measured as the change in current operating assets net of cash and short-term investments, minus the change in current operating liabilities net of short-term debt. Noncurrent operating accruals, $\Delta NCO_{it}$, is the change in noncurrent assets net of long-term nonequity investments and advances, less the change in noncurrent liabilities net of long-term debt. The change in net financial assets, $\Delta FIN_{it}$, is the change in short-term investments and long-term investments less the change in short-term debt, long-term debt, and preferred stock. *Total accruals* is measured using annual data, so it is the same for all months $t$ in a given fiscal year.

To measure *Insider selling*, we first calculate net insider selling in each month as the difference between the shares sold and bought by insiders, divided by the firms' outstanding shares. *Insider selling* is then defined as the difference between this measure of net insider selling and its mean over the previous 12 months. A higher number of this variable indicates a higher level of sales by insiders.

The last column of Table III reports the means of the coefficients when *Total accruals* and *Insider selling* are included in the monthly cross-sectional regressions for short interest. Short interest is positively related to both measures. This indicates that short sellers respond to public information about accruals and insiders' trades, even in the absence of financial misrepresentation.

To check the robustness of our results, we replicated many of the tests reported in this paper using four alternate measures of abnormal short interest. The first adds to *ABSI*(3) a control for the dispersion in analysts' forecasts, which Diether, Malloy, and Scherbina (2002) show is correlated with the cost of selling short. The second adds the firm's short interest at the beginning of the violation period as a matching criterion in selecting comparison firms that comprise the benchmark sample. The third uses each firm's own level of short interest before its violation period as its benchmark level of "normal" short interest. And the fourth defines abnormal short interest as a binary variable equal to one when raw monthly short interest exceeds the firm's pre-violation mean level by three standard deviations (this is similar to the method used by Dyck, Morse, and Zingales (2010)). As reported in the Internet Appendix, the results using any of these alternate measures are similar to those reported here.

## III. Do Short Sellers Identify Misrepresenting Firms?

### *A. Short Interest around the Revelation of Misrepresentation*

Table IV and Figure 2 report on monthly raw and abnormal short interest during the 40-month period surrounding the month in which financial misconduct is publicly revealed. We have at least some short interest data for 474 firms in the sample, but many of these firms do not have sufficient data to calculate abnormal short interest in some months. This is for two reasons. First, the data required to calculate abnormal short interest are not available for all firms in all months. The data requirements are most severe for *ABSI*(3), so our sample sizes typically decrease as we move from *ABSI*(1) to *ABSI*(3). The second reason is that some firms enter the sample fewer than 19 months before their public revelation dates, while some firms leave the sample or do not have short interest data available in the months after public revelation. In sensitivity tests, we find that the results do not change if we restrict the sample to include only firms with data available for all months in the [−19, 0] period.[10]

Average raw short interest $\overline{SI}_t$ increases steadily from month −19 through month 0, reaching a peak in month +5 before gradually decreasing through month +20. The patterns for all three measures of abnormal short interest are similar. The cross-sectional mean of $ABSI(1)_{it}$, $\overline{ABSI(1)}_t$, is positive in

[10]The results also are not sensitive to the [−19, +20] window. In general, abnormal short interest becomes statistically significant around month −17, and it increases steadily, although not monotonically, until 5 months after public revelation. We also find similar results when the data are partitioned into 1988 to 1996 and 1997 to 2005 subperiods.

**Table IV**

## Short Interest and Abnormal Short Interest around the Revelation of Misconduct

This table reports the mean levels of short interest ($SI$) and abnormal short interest ($ABSI(j)$) for firms in the financial misrepresentation sample during the 40-month window around the revelation of financial misrepresentation. Month 0 is the month in which the financial misrepresentation was publicly revealed. Abnormal short interest ($ABSI(j)_{it}$) for each event firm $i$ in month $t$ is the difference between the short interest and the predicted short interest using the coefficients in month $t$ using model $j$, $j$ = 1,2,3. The time-series means of the coefficients from each model, $j$ = 1,2,3, are reported in Table III. Short interest ($SI_{it}$) is the number of shares shorted as a percentage of the number of shares outstanding in month $t$. $N$ is the number of firms used in calculating the average for each month in event time. The number of firms changes due to limited availability of data on short interest or the variables used to calculate abnormal short interest. $t$-statistics test whether $SI$ and $ABSI(j)$ differ significantly from zero.

| | | | | Model 1 | | | Model 2 | | | Model 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | $SI$ | $N$ | $t$-stat | $ABSI(1)$ | $N$ | $t$-stat | $ABSI(2)$ | $N$ | $t$-stat | $ABSI(3)$ | $N$ | $t$-stat | $\Delta ABSI(3)$ |
| −19 | 1.916 | 245 | 8.59 | 0.320 | 212 | 1.38 | 0.137 | 212 | 0.62 | 0.218 | 179 | 0.88 | |
| −18 | 2.254 | 257 | 6.97 | 0.577 | 219 | 1.63 | 0.380 | 219 | 1.12 | 0.528 | 190 | 1.37 | 0.310 |
| −17 | 2.401 | 261 | 7.23 | 0.695 | 226 | 2.00 | 0.515 | 226 | 1.52 | 0.605 | 196 | 1.57 | 0.077 |
| −16 | 2.508 | 275 | 7.72 | 0.821 | 235 | 2.43 | 0.644 | 235 | 1.99 | 0.734 | 207 | 2.03 | 0.129 |
| −15 | 2.463 | 291 | 8.45 | 0.797 | 245 | 2.55 | 0.593 | 245 | 1.99 | 0.682 | 217 | 2.04 | −0.053 |
| −14 | 2.603 | 305 | 8.89 | 0.911 | 260 | 2.93 | 0.703 | 260 | 2.37 | 0.857 | 224 | 2.51 | 0.175 |
| −13 | 2.736 | 323 | 8.97 | 1.067 | 273 | 3.23 | 0.823 | 273 | 2.60 | 0.915 | 239 | 2.59 | 0.058 |
| −12 | 2.943 | 319 | 8.94 | 1.260 | 267 | 3.55 | 1.062 | 267 | 3.12 | 1.190 | 234 | 3.19 | 0.276 |
| −11 | 3.178 | 332 | 9.61 | 1.476 | 277 | 4.01 | 1.270 | 277 | 3.58 | 1.374 | 241 | 3.51 | 0.184 |
| −10 | 3.212 | 357 | 10.1 | 1.512 | 294 | 4.2 | 1.261 | 294 | 3.67 | 1.382 | 256 | 3.63 | 0.008 |
| −9 | 3.362 | 361 | 10.1 | 1.743 | 309 | 4.66 | 1.443 | 309 | 4.03 | 1.425 | 262 | 3.52 | 0.042 |
| −8 | 3.419 | 374 | 10.2 | 1.746 | 323 | 4.70 | 1.387 | 323 | 3.91 | 1.399 | 278 | 3.57 | −0.026 |
| −7 | 3.362 | 386 | 10.7 | 1.667 | 336 | 4.80 | 1.355 | 336 | 4.06 | 1.417 | 290 | 3.80 | 0.018 |
| −6 | 3.424 | 391 | 11.7 | 1.646 | 340 | 5.9 | 1.214 | 340 | 3.99 | 1.412 | 293 | 4.06 | −0.005 |
| −5 | 3.432 | 407 | 11.6 | 1.719 | 349 | 5.30 | 1.296 | 349 | 4.15 | 1.513 | 301 | 4.28 | 0.101 |
| −4 | 3.242 | 411 | 11.5 | 1.492 | 361 | 4.94 | 1.132 | 361 | 3.94 | 1.302 | 310 | 4.02 | −0.211 |
| −3 | 3.422 | 410 | 11.8 | 1.632 | 361 | 5.34 | 1.247 | 361 | 4.23 | 1.441 | 314 | 4.38 | 0.140 |
| −2 | 3.564 | 407 | 12.4 | 1.760 | 364 | 5.85 | 1.308 | 364 | 4.51 | 1.449 | 315 | 4.48 | 0.008 |
| −1 | 3.743 | 405 | 12.2 | 1.890 | 361 | 5.87 | 1.451 | 361 | 4.68 | 1.651 | 314 | 4.75 | 0.203 |

(*continued*)

**Table IV**—*Continued*

| | | | | Model 1 | | | Model 2 | | | Model 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | *SI* | *N* | *t*-stat | *ABSI*(1) | *N* | *t*-stat | *ABSI*(2) | *N* | *t*-stat | *ABSI*(3) | *N* | *t*-stat | Δ*ABSI*(3) |
| 0 | 3.815 | 374 | 12.3 | 1.981 | 313 | 5.86 | 1.513 | 313 | 4.64 | 1.682 | 274 | 4.62 | 0.030 |
| 1 | 3.940 | 324 | 11.7 | 2.168 | 282 | 5.99 | 1.379 | 282 | 3.90 | 1.756 | 241 | 4.33 | 0.074 |
| 2 | 4.001 | 308 | 11.8 | 1.966 | 269 | 5.82 | 1.395 | 269 | 4.23 | 1.676 | 232 | 4.45 | −0.080 |
| 3 | 4.007 | 300 | 11.9 | 2.016 | 275 | 5.86 | 1.489 | 275 | 4.47 | 1.736 | 233 | 4.57 | 0.060 |
| 4 | 3.938 | 288 | 11.4 | 1.936 | 272 | 5.54 | 1.502 | 272 | 4.49 | 1.730 | 233 | 4.56 | −0.006 |
| 5 | 4.100 | 286 | 11.1 | 2.111 | 271 | 5.59 | 1.638 | 271 | 4.44 | 1.892 | 231 | 4.52 | 0.162 |
| 6 | 4.038 | 277 | 10.6 | 1.669 | 264 | 4.73 | 1.276 | 264 | 3.77 | 1.451 | 230 | 3.85 | −0.441 |
| 7 | 3.558 | 276 | 11.3 | 1.450 | 262 | 4.59 | 1.099 | 262 | 3.66 | 1.263 | 228 | 3.78 | −0.189 |
| 8 | 3.456 | 265 | 12.0 | 1.319 | 253 | 4.63 | 0.949 | 253 | 3.45 | 1.059 | 222 | 3.55 | −0.204 |
| 9 | 3.313 | 258 | 12.1 | 1.201 | 249 | 4.37 | 0.779 | 249 | 2.98 | 0.897 | 219 | 3.19 | −0.162 |
| 10 | 3.404 | 256 | 12.2 | 1.318 | 249 | 4.73 | 0.849 | 249 | 3.16 | 1.035 | 218 | 3.49 | 0.138 |
| 11 | 3.446 | 250 | 12.1 | 1.271 | 243 | 4.51 | 0.925 | 243 | 3.40 | 1.046 | 213 | 3.53 | 0.012 |
| 12 | 3.195 | 251 | 11.7 | 1.043 | 243 | 3.64 | 0.677 | 243 | 2.42 | 0.782 | 211 | 2.51 | −0.264 |
| 13 | 3.171 | 242 | 11.3 | 1.052 | 234 | 3.61 | 0.667 | 234 | 2.31 | 0.762 | 205 | 2.40 | −0.020 |
| 14 | 3.128 | 243 | 11.1 | 1.059 | 233 | 3.75 | 0.724 | 233 | 2.65 | 0.839 | 203 | 2.78 | 0.077 |
| 15 | 2.929 | 242 | 10.7 | 0.844 | 236 | 3.09 | 0.615 | 236 | 2.31 | 0.747 | 206 | 2.54 | −0.092 |
| 16 | 2.865 | 238 | 10.8 | 0.743 | 231 | 2.80 | 0.527 | 231 | 2.04 | 0.704 | 202 | 2.48 | −0.043 |
| 17 | 2.833 | 235 | 11.4 | 0.640 | 228 | 2.50 | 0.337 | 228 | 1.34 | 0.407 | 201 | 1.48 | −0.298 |
| 18 | 2.891 | 232 | 11.3 | 0.669 | 225 | 2.71 | 0.486 | 225 | 2.03 | 0.557 | 199 | 2.13 | 0.151 |
| 19 | 2.940 | 227 | 11.3 | 0.691 | 221 | 2.63 | 0.496 | 221 | 1.94 | 0.616 | 196 | 2.22 | 0.059 |
| 20 | 2.934 | 222 | 10.9 | 0.751 | 214 | 2.68 | 0.498 | 214 | 1.82 | 0.620 | 190 | 2.09 | 0.003 |

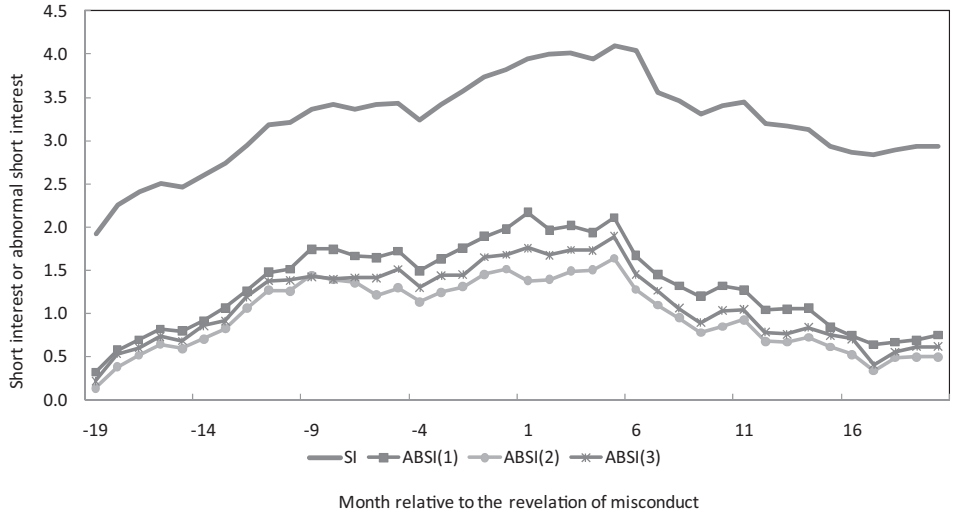


**Figure 2. Short interest around the revelation of misconduct.** This figure plots the data reported in Table IV, which contains the mean levels of raw and abnormal short interest in the 40-month window around the public revelation of misconduct for the sample of firms targeted in SEC enforcement actions for financial misrepresentation from 1988 to 2005. Month 0 is the month in which the misrepresentation was first publicly revealed. *SI* is the mean level of raw short interest. *ABSI*(1), *ABSI*(2), and *ABSI*(3) refer to the three different measures of abnormal short interest. Each measure of abnormal short interest equals raw short interest minus the predicted short interest using the model parameters summarized in Table III.

month −19, indicating that these firms are more highly shorted than other firms in the portfolio matched by size, book-to-market, momentum, and industry. However, $\overline{ABSI(1)}_t$ does not differ significantly from zero at the 5% level until month −17. In month −1, $\overline{ABSI(1)}_{-1}$ has a value of 1.890, meaning that the misconduct firms' short interest as a percentage of shares outstanding is 1.890 percentage points higher than that of firms in the control portfolio. Given that the unconditional mean short interest in any given firm-month is only 1.65% of outstanding shares, this means that short interest in month −1 is more than double the unconditional sample mean level of short interest.

The second and third measures of abnormal short interest are smaller than $\overline{ABSI(1)}_t$ in every month, but both follow a similar pattern. In month −1, $\overline{ABSI(2)}_{-1}$ equals 1.451 and $\overline{ABSI(3)}_{-1}$ equals 1.651. Thus, controlling for share turnover and institutional ownership partly explains the abnormal increase in short interest that is reflected in $\overline{ABSI(1)}_{-1}$. But controlling for total accruals and insider selling does not further decrease the measure of abnormal short interest. These results indicate that the build-up of short interest before the public revelation of financial misrepresentation is not fully explained by observable firm characteristics such as total accruals and insiders' trades. As reflected in Table III, short selling *in general* is sensitive to these characteristics. The build-up of short interest while firms misrepresent their financial

statements, however, is attributable to something else. A plausible explanation is that short sellers act on private information or public information that is not yet reflected in share prices. This is consistent with anecdotes (e.g., as in Einhorn (2008)) that short sellers identify overpriced shares through a combination of fundamental analysis and private investigation.

The far right column in Table IV reports the monthly change in the third measure of abnormal short interest, $\Delta\overline{ABSI(3)}_t$. Fifteen of the 19 monthly changes up through month 0 are positive, indicating that the build-up of short interest is fairly steady. To measure the average monthly rate at which abnormal short interest grows in the pre-revelation period, we estimate the following pooled regression model using firm fixed effects:

$$ABSI(j)_{it} = a_i + \delta \cdot t + \varepsilon_{it}, \tag{4}$$

where $t$ is a time trend ranging from $-19$ to $-1$. We include firm fixed effects to account for heterogeneity in short-selling activity across firms. Using the first measure of abnormal short interest, $ABSI(1)_{it}$, the estimate of the coefficient for the time trend $\hat{\delta}$ is 0.073 with a $t$-statistic of 11.7. This indicates that abnormal short interest increases by an average amount of 0.073 percentage points in each of the 19 months leading up to the public revelation of financial misrepresentation. The coefficient $\hat{\delta}$ using the second measure is 0.057 ($t = 9.1$), and for the third measure is 0.054 ($t = 7.9$).

The data from Table IV are illustrated in Figure 2. Raw short interest, as well as all three measures of abnormal short interest, increase over the 19 months before the public revelation of financial misconduct, and slowly unwind during the 20 months after public revelation. The Internet Appendix contains an extension of Figure 2 that illustrates the overall pattern of short selling around both the initiation and discovery of financial misconduct.

Notice that abnormal short interest does not immediately drop toward zero in the months after the misconduct is publicly revealed. Instead, it remains high for several months before gradually decreasing, remaining statistically different from zero many months after the revelation. Our short interest data do not provide the individual identities of each short seller, so it is possible that the abnormal short interest after month 0 represents new short sellers taking new positions in the stock. It is also possible that short sellers take time to wind down their positions after month 0. Under either scenario, short sellers can profit even after the initial revelation of misconduct. The evidence in Panel B of Table II indicates that share prices tend to decline upon subsequent announcements about the misconduct and penalty.

### *B. Short Interest and the Severity of Misrepresentation*

The evidence in Table IV indicates that short sellers detect financial misrepresentation before it is publicly revealed. To probe this interpretation, we examine whether the amount of short selling is related to the severity of the misrepresentation. If short sellers are skilled at ferreting out information about

these firms' overvaluation, we would expect short selling to be most pronounced in the firms with the most severe reporting irregularities.

We examine cross-sectional differences in the amount of abnormal short interest at month −1 using the following specification:

$$ABSI(j)_{i,-1} = \lambda_0 + \lambda_1 Severity_{i,-1} + \lambda_2 Controls_{i,-1} + \varepsilon_{i,}\ j = 1, 2, 3. \quad (5)$$

Here, $ABSI(j)_{i,-1}$ is firm $i$'s abnormal short interest measured at the end of month −1, and $Severity_i$ is a measure of the severity of the misconduct. One potential measure of the misconduct's severity is the drop in share value when news of the misconduct is made public. Indeed, we find that the stock return on the trigger date is significantly related to all three measures of abnormal short interest, indicating that short selling is particularly active before public revelations of misconduct that precipitate large price drops. Unfortunately, this result does not directly tie short selling to the misrepresentation's severity. It is possible that short sellers have no specific knowledge of the misrepresentation, and are good only at anticipating large stock price declines. It could also be argued that short sellers manipulate or engineer the large stock price declines. To distinguish between these competing interpretations, we need measures of severity that directly measure the extent of managers' misconduct.

To do that, we use three different proxies for *Severity*: *Fraud*, *Insider trading charges*, and *Total accruals*. The first of these proxies, *Fraud*, is a dummy variable that equals one if the enforcement action includes fraud charges under: (i) section 17(a) of the 1933 Securities Act, which covers fraudulent actions in the sale of new securities; (ii) sections 10(a) or 10(b) of the 1934 Exchange Act, which cover fraudulent actions in the purchase or sale of existing securities; or (iii) sections 15 or 18 of the United States Code, which cover criminal fraud charges. Contrary to popular use of the term "fraud," specific charges of fraud are not universal in SEC enforcement actions for misconduct. Fraud charges are relatively difficult for the SEC or Department of Justice to prove, so they tend to be included only when the financial misrepresentation is egregious and costly (for a discussion, see Cox, Thomas, and Kiku (2003)). In our sample, 79% of all enforcement actions include at least one fraud charge.

Our second proxy for severity, *Insider trading charges*, takes the value of one if the enforcement action includes at least one charge of insider trading under sections 10(b)5–1 and 10(b)5–2 of the Exchange Act. In our sample, 19% of all actions include at least one such charge. Agrawal and Cooper (2008) conclude that many managers trade on personal account when their firms' books are in error, and Karpoff, Lee, and Martin (2009) report that securities class action settlements for financial misrepresentation are higher when insider trading charges are included. These results indicate that insider trading charges are associated with egregious and costly misrepresentations.

Our third measure of the severity of the misrepresentation is *Total accruals*, as presented in equation (3). Healy (1985), Dechow et al. (2010), and others have shown that accruals can be used to manipulate earnings. We hypothesize

that the size of *Total accruals* correlates with the materiality of the financial misrepresentation.

To verify that *Fraud*, *Insider trading charges*, and *Total accruals* are good proxies for the severity of misconduct, we estimated the relation between each proxy and the market-adjusted 1-day return on the revelation date, using the same control variables as in Table V. The results, reported in the Internet Appendix, indicate that each proxy is negatively and significantly related to the abnormal return on the revelation date ($p$-values of 0.02 or smaller), indicating that each is a good measure of severity. One way to think of these proxies is that each is an instrumental variable for the stock price reaction to the public revelation of misrepresentation. The use of these instrumental variables avoids an errors-in-variables problem that would arise if we used the stock return to measure severity in equation (5), because short interest and the stock return upon public revelation both are simultaneously determined by the severity of the misconduct.[11]

Models 1 to 3 in each panel of Table V report the results when equation (5) is estimated using the three different measures of severity. Each variable is measured at the end of the month just before the public revelation month. The coefficients are all positive and statistically significant, implying that short selling before the public revelation is significantly related to the severity of the misrepresentation. In Model 1 of Panel A, the *Fraud* coefficient indicates that short interest is 1.650 percentage points higher, on average, when fraud charges are included in the enforcement action. Short interest is 2.034 percentage points higher when the enforcement action includes insider trading charges. The *Total accruals* coefficient of 5.151 indicates that an increase from the $10^{th}$ percentile to the $90^{th}$ percentile in the *Total accruals* measure corresponds to an increase in short interest of approximately 3.021 percentage points. Similar estimates of the economic effects obtain from the results in Panels B and C.

Model 4 in each of the panels includes all three *Severity* proxies in one regression. In all three panels, the coefficients are positive, although only *Total accruals* remains significant at the 5% level in all three panels. This could reflect the high correlations among these proxies.

Among the control variables, high institutional ownership implies more shares available on the stock loan market, which lowers the cost of shorting and increases short interest. The *Size* coefficient is negative and significant, indicating abnormal short interest is relatively small in large firms. This could reflect the fact that size loads positively in constructing the benchmark levels

[11]The Internet Appendix reports results for four alternate measures of misconduct severity: (i) the monetary award in the private class action lawsuit related to the firm's misconduct, (ii) the monetary fines imposed by regulators, (iii) Karpoff et al. (2009) index of non-monetary penalties imposed by regulators, and (iv) whether the firm subsequently declared bankruptcy. Measures (i), (ii), and (iv) are significantly related to abnormal short interest, and yield results that are similar to those for *Fraud* and *Total accruals* in Table V. When the alternate measures are included in the tests, the coefficients on *Fraud*, *Insider trading charges*, and *Total accruals* all are positive, generally with lower $p$-values than reported in the tables.

**Table V**

## Determinants of Abnormal Short Interest at Month −1 Relative to Public Revelation

This table reports the estimates and corresponding $p$-values for cross-sectional regressions that estimate the determinants of abnormal short interest in the month immediately before the month in which financial misrepresentation is revealed to the public:

$$ABSI(j)_{i,-1} = \lambda_0 + \lambda_1 Severity_{i,-1} + \lambda_2 Controls_{i,-1} + \varepsilon_{i,} \; j = 1, 2, 3.$$

The sample includes all SEC enforcement actions on NYSE/Amex/NASDAQ-listed firms for which data on short interest, market capitalization, book-to-market, and momentum are available over the period 1988 to 2005. *Fraud* is a dummy variable that equals one if the enforcement action includes fraud charges under Section 17(a) of the 1933 Securities Act or Section 10 of the 1934 Security Exchange Act. *Insider trading charges* is a dummy variable that equals one if the action includes charges of insider trading. *Total accruals* is based on the measure in Richardson et al. (2005). *Institutional ownership* is from the CDA/Spectrum database; *Size* is measured as the log of market capitalization; *Book-to-market ratio* is the ratio of book assets to the sum of book liabilities and the market value of equity; and *Momentum* is calculated as the previous 12-month cumulative return.

| | Panel A: *ABSI*(1) | | | | Panel B: *ABSI*(2) | | | | Panel C: *ABSI*(3) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Severity measures: | | | | | | | | | | | | |
| Fraud | 1.650 | | | 1.328 | 1.847 | | | 1.547 | 1.977 | | | 1.529 |
| | (0.03) | | | (0.13) | (0.01) | | | (0.08) | (0.02) | | | (0.08) |
| Insider trading charges | | 2.034 | | 1.299 | | 1.767 | | 1.046 | | 1.860 | | 1.005 |
| | | (0.01) | | (0.12) | | (0.01) | | (0.20) | | (0.02) | | (0.22) |
| Total accruals | | | 5.151 | 4.470 | | | 4.650 | 4.050 | | | 4.181 | 3.601 |
| | | | (0.00) | (0.00) | | | (0.00) | (0.01) | | | (0.00) | (0.01) |
| Control variables: | | | | | | | | | | | | |
| Inst. ownership | 0.086 | 0.089 | 0.097 | 0.094 | 0.070 | 0.074 | 0.083 | 0.079 | 0.077 | 0.082 | 0.082 | 0.078 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Size | −0.692 | −0.727 | −0.827 | −0.746 | −0.582 | −0.629 | −0.740 | −0.651 | −0.600 | −0.682 | −0.729 | −0.641 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Book-to-market ratio | 0.158 | 0.159 | 0.141 | 0.174 | 0.136 | 0.130 | 0.135 | 0.168 | 0.160 | 0.158 | 0.140 | 0.172 |
| | (0.27) | (0.26) | (0.37) | (0.27) | (0.33) | (0.35) | (0.39) | (0.28) | (0.31) | (0.31) | (0.37) | (0.27) |
| Momentum | 0.005 | 0.003 | 0.005 | 0.005 | 0.006 | 0.003 | 0.006 | 0.006 | 0.007 | 0.004 | 0.006 | 0.005 |
| | (0.32) | (0.60) | (0.34) | (0.42) | (0.27) | (0.51) | (0.28) | (0.31) | (0.22) | (0.46) | (0.30) | (0.33) |
| Intercept | 0.798 | 1.702 | 1.872 | 0.254 | 0.258 | 1.434 | 1.573 | −0.189 | 0.069 | 1.428 | 1.575 | −0.159 |
| | (0.46) | (0.04) | (0.04) | (0.83) | (0.81) | (0.08) | (0.08) | (0.87) | (0.95) | (0.12) | (0.08) | (0.89) |
| $N$ | 361 | 361 | 315 | 315 | 361 | 361 | 315 | 315 | 314 | 314 | 314 | 314 |
| Adj-$R^2$ | 0.11 | 0.12 | 0.15 | 0.16 | 0.09 | 0.09 | 0.12 | 0.13 | 0.10 | 0.10 | 0.11 | 0.12 |

of expected short interest. Neither the book-to-market ratio nor momentum has a significant impact on abnormal short interest.

The regressions in Table V analyze the determinants of short interest at one point in the time line, namely, the last month before the exposure of the misconduct. In the Internet Appendix, we report on how the change in abnormal short interest from month −19 to month −1 is related to the severity of the misconduct. The results from these tests indicate that short interest and its build-up are positively related to the severity of the misrepresentation that subsequently is revealed to the public. Short sellers not only pre-identify firms that get into trouble for misrepresenting their financial statements, but they also take larger positions when the misrepresentation is particularly egregious. That is, short sellers appear to anticipate both the existence and severity of financial misrepresentation.

### *C. Do Short Sellers Focus on Misrepresenting Firms?*

The evidence in Tables IV and V (as well as the accompanying results in the Internet Appendix) indicates that short sellers detect financial misrepresentation before it is publicly revealed, and that the extent of short selling is sensitive to the severity of the misrepresentation. But these results are from firms that, ex post, faced SEC sanctions for misconduct. They do not address the question of whether short selling *in general* tends to predict the existence of (yet undisclosed) misrepresentation. To explore this issue, we examine whether high levels of abnormal short interest are related to the presence of financial misconduct, using data from all firms for which we have short interest data. Table VI reports results using $ABSI(1)$, although the results are similar using $ABSI(2)$ or $ABSI(3)$.

For each month $t$, we classify firms along two dimensions. Firms with $ABSI(1)$ in the top 5% are identified as "high short interest firms," while those in the bottom 95% are "low short interest firms." If month $t$ overlaps with an SEC-identified violation period for firm $i$, it is designated as a "violation firm-month." This classifies every firm-month in the sample according to whether the firm had high short interest and whether it was cooking its books.

Panel A of Table VI reports on the resulting $2 \times 2$ matrix. If short interest tends to be high when firms misrepresent their financial statements, we should see a higher-than-random concentration along the diagonal. That is, high short interest firm-months should correspond with violation firm-months, and low short interest firm-months should correspond with nonviolation firm-months. This is exactly what we find. For example, 1.78% of all firm-months are in the "violation" category. But among the high short interest firm-months, 4.18% are in the violation category. A chi-squared test rejects the null hypothesis that the short interest and violation categories are unrelated ($\chi^2 = 1{,}912$, $p$-value $=$ 0.00).

Panel A includes all firm-months for which we have short interest data. Panel B excludes data from months between the public revelation of the misconduct and the end of the SEC enforcement action. This affects only firms with SEC

**Table VI**

## Short Interest and the Presence or Absence of Financial Misconduct

Each panel groups all firm-months into four cells based on a two-way classification: (i) whether the amount of abnormal short interest is low or high, and (ii) whether the firm subsequently is identified as having misrepresented its financial statements in that month. In Panel A, all firm-months from the beginning of a firm's violation to the end of its enforcement action are included in the "Violation" column. Panel B deletes all firm-months between the public exposure of the violation to the end of the enforcement action. A firm-month is assigned to the "High *ABSI*" group if the firm's abnormal short interest in that month is above the 95$^{th}$ percentile of *ABSI* in the entire cross section of firms for that month. The table reports results based on our first measure of abnormal short interest, *ABSI*(1), although similar results obtain for *ABSI*(2) and *ABSI*(3). The sample includes all NYSE/Amex/NASDAQ stocks that are in the intersection of CRSP, Compustat, and the short interest data set.

| | | Panel A: All Firm-Months "High *ABSI*" = 1 if *ABSI* ≥ 95$^{th}$ Percentile | | | Panel B: Excluding Months after the Enforcement Actions Begins "High *ABSI*" = 1 if *ABSI* ≥ 95$^{th}$ Percentile | | |
|---|---|---|---|---|---|---|---|
| | | No Violation | Violation | Total | No Violation | Violation | Total |
| Low | Frequency | 1,024,754 | 17,225 | 1,041,979 | 1,024,008 | 8,719 | 1,032,727 |
| ABSI | Percent | 93.42 | 1.57 | 94.99 | 94.19 | 0.80 | 94.99 |
| | Row % | 98.35 | 1.65 | | 99.16 | 0.84 | |
| | Column % | 95.11 | 88.22 | | 95.04 | 89.19 | |
| High | Frequency | 52,658 | 2,299 | 54,957 | 53,404 | 1,057 | 54,461 |
| ABSI | Percent | 4.8 | 0.21 | 5.01 | 4.91 | 0.10 | 5.01 |
| | Row % | 95.82 | 4.18 | | 98.06 | 1.94 | |
| | Column % | 4.89 | 11.78 | | 4.96 | 10.81 | |
| Total | | 1,077,412 | 19,524 | 1,096,936 | 1,077,412 | 9,776 | 1,087,188 |
| | | 98.22 | 1.78 | 100 | 99.10 | 0.90 | 100 |
| Chi-squared statistic | | 1,911.66 | *p*-value | 0 | 698.08 | *p*-value | 0 |

enforcement actions, and has the effect of deleting observations for which short interest may be high, even though the misconduct is public knowledge. Removing these observations yields results that are similar to Panel A. For example, in Panel B, $\chi^2 = 698$ with a $p$-value $= 0.00$. These results are consistent with the hypothesis that there is a systematic relation between high short interest and the presence of financial misconduct that has not yet been revealed to the public. That is, short interest is a predictor of the existence of financial misrepresentation in general.[12]

## IV. Short Sellers' External Effects on Other Investors

In this section, we examine whether short sellers confer external costs or benefits on other investors. A potential external cost is that short selling may exacerbate a downward price spiral when the misconduct is publicly revealed. A potential benefit is that short selling may help uncover the misconduct. A second potential benefit is that short selling may dampen the stock price inflation that occurs when the firm's books are in error.

### *A. Short Selling and the Share Price Reaction to News of Misconduct*

Critics of short selling argue that it can cause prices to deviate from fundamental values, particularly when bad news hits the market. In written testimony for the U.S. House Committee on Financial Services, for example, MBIA Inc. argues that short sellers increased the downward price pressure on insurers that faced large losses in the U.S. mortgage markets (see Wilchins (2008)). Short selling, according to this view, creates a cascade of selling that leads to overreaction to bad news and drives prices down too far. The SEC's October 2008 moratorium on naked short selling in selected financial institutions was based in part on this theory, as SEC Chairman Christopher Cox argued that short selling contributed to large share price declines at such firms as Lehman Brothers, Bear Stearns, Fannie Mae, and Freddie Mac.[13]

To investigate this argument, we examine how short selling is related to the stock price reaction when financial misconduct is revealed to the public. In particular, we estimate the following cross-sectional regression:

$$AR_i = a + f_1\, ABSI(j)_{i,-1} + f_2\, Severity_i + f_3\, Controls_i + e_i,\ \ j = 1, 2, 3, \quad (6)$$

where $AR_i$ is the market-adjusted return on the day misrepresentation is first publicly revealed, and $ABSI(j)_{i,-1}$ is firm $i$'s abnormal short interest in the month before the month of the revelation date. If the announcement day abnormal return is sensitive to the severity of the misconduct, $f_2$ should be negative.

[12]For a more comprehensive investigation of variables that predict financial misconduct, see Dechow et al. (2010). Our results indicate that abnormal short interest should be included in such tests. The Internet Appendix reports that we obtain similar results when "high short interest" is defined as the top 10% of $ABSI(1)$.

[13]See "What the SEC really did on short selling," *The Wall Street Journal*, July 24, 2008, A15, and Zarroli (2008).

**Table VII**

## Short Sellers and the Market Penalty for Misrepresentation

This table reports the estimates and corresponding $p$-values for cross-sectional regressions that estimate the determinants of the market-adjusted abnormal return on the day financial misrepresentation is publicly revealed ($AR_i$):

$$AR_i = a + f_1\, ABSI(1)_{i,-1} + f_2\, Severity_i + f_3\, Controls_i + e_i.$$

The sample includes all SEC enforcement actions for NYSE/Amex/NASDAQ-listed firms for which data are available over the period 1988 to 2005. Variables are defined as in Tables IV and V.

| | Model | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Abnormal short interest, ABSI(1)$_{i,-1}$ | −0.314 | −0.231 | −0.185 | −0.191 | −0.052 |
| | (0.10) | (0.23) | (0.33) | (0.34) | (0.79) |
| Fraud | | −9.695 | | | −7.475 |
| | | (0.00) | | | (0.01) |
| Insider trading charges | | | −11.774 | | −9.050 |
| | | | (0.00) | | (0.00) |
| Total accruals | | | | −14.850 | −11.181 |
| | | | | (0.00) | (0.02) |
| Institutional ownership | −0.073 | −0.056 | −0.076 | −0.064 | −0.052 |
| | (0.15) | (0.26) | (0.12) | (0.22) | (0.30) |
| Size | 1.699 | 1.367 | 1.627 | 1.423 | 1.059 |
| | (0.00) | (0.01) | (0.00) | (0.02) | (0.08) |
| Book-to-market ratio | 0.047 | 0.042 | 0.036 | 0.035 | 0.025 |
| | (0.10) | (0.13) | (0.18) | (0.21) | (0.35) |
| Momentum | −0.012 | −0.012 | −0.007 | −0.012 | −0.009 |
| | (0.07) | (0.06) | (0.27) | (0.07) | (0.17) |
| Intercept | −24.04 | −15.42 | −21.12 | −21.10 | −12.31 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| $N$ | 340 | 340 | 340 | 295 | 295 |
| Adj-$R^2$ | 0.04 | 0.07 | 0.10 | 0.05 | 0.12 |

If, in addition, short selling causes an overreaction that is not related to the severity of the misconduct, $f_1$ should be negative as well.

Table VII presents the results using our first measure of abnormal short interest, $ABSI(1)$. In Model 1, the coefficient for $ABSI(1)_{i,-1}$ is negative and significant at the 10% level. This appears to provide support for the view that short selling exacerbates the price drop when bad news hits the market. But Model 1 does not control for the severity of the misconduct. The negative relation between the abnormal stock return and abnormal short interest might simply reflect short sellers' tendencies—documented earlier in Table V—to take larger positions when the misrepresentation is particularly bad.

When we include our measures of severity, as in Models 2–5, the coefficient for $ABSI(1)_{i,-1}$ becomes statistically insignificant. Instead, the coefficients for the severity measures are negative and significant. The results are more pronounced when we use $ABSI(2)_{i,-1}$ or $ABSI(3)_{i,-1}$ to measure abnormal short

interest; in these cases the abnormal return is not significantly related to abnormal short interest, but is strongly and negatively related to all three measures of misconduct severity. These results indicate that short-selling activity does not have a significant, independent effect on the market reaction to news of financial misconduct. This is inconsistent with the view that short selling causes an unwarranted downward spiral in the stock price when bad news is announced.

We also examine the stock price behavior after the initial disclosure of misconduct. If short selling causes overreaction—either in the short term or long term—then we should see differences in the stock price paths of our sample firms that correspond to differences in short interest. The results, however, do not support an overreaction story. In results reported in the Internet Appendix, we partitioned the sample according to abnormal short interest in month $-1$. We find no evidence of overreaction on the public revelation day (day 0) in either the high-*ABSI* or low-*ABSI* groups, as there is no price reversal after day 0 in either group. We also find no significant difference in the cumulative excess returns between the high-*ABSI* and low-*ABSI* groups over horizons up to 180 days after day 0. These results indicate that the market responds to the severity of misconduct. But there is no evidence that short selling in and of itself imposes additional downward price pressure, either on the public revelation day or afterwards.

### *B. Do Short Sellers Help Expose Financial Misrepresentation?*

#### *B.1. Short Interest and the Time to Revelation*

Short selling advocates (e.g., Einhorn (2008)) argue that short sellers generate external benefits by helping to expose financial misrepresentation. To our knowledge, this assertion has not been tested, although a recent paper by Dyck et al. (2010) provides some evidence. Dyck et al. examine spikes in short interest before the announcements of security class action lawsuits from 1996 to 2004, most of which are for financial misrepresentation. An event is labeled "detected by short sellers" if the raw short interest during the 3 months before the filing date exceeds the firm's short interest in the prior year by three standard deviations. Dyck et al. conclude that between 3.4% and 14.5% of their 216 events are detected by short sellers. This estimate suggests that short sellers play a modest role in helping to uncover financial misconduct.

We examine this issue by estimating survival models that measure how short selling affects the time it takes for misrepresentation to be publicly revealed. Specifically, we model the logarithm of the time to revelation, $\log(M_i)$, as

$$\log(M_i) = \beta' X_i + \varepsilon_i. \tag{7}$$

Here, $M_i$ is the number of months from the beginning of firm $i$'s violation until its revelation, $X_i$ is the vector of possibly time-varying covariates assumed to influence the time until public revelation, and $\beta$ is a vector of regression

parameters that we estimate. The error term $\varepsilon_i$ is assumed to follow the logistic distribution.[14]

In estimating the model, we use data from all months from violation until the revelation of misconduct. Letting $T_{it}$ denote the number of months from the start of violation, we use all firm-months such that $0 < T_{it} \leq M_i$. The explanatory variables $X_i$ are measured at the beginning of each month $t$. For each month $t$, we observe the following vector $[t, Revelation_i, X_i]$, where $Revelation_i$ is a dummy variable that equals one if the firm's misconduct is revealed in month $t$ ($M_i = T_{it}$) and zero otherwise ($M_i > T_{it}$). A log-likelihood function can then be constructed to estimate the parameter vector $\beta$. To mitigate contamination from outliers, only violations that last between 1 and 10 years are included in the estimates we report, although the results are not sensitive to the inclusion of all events. In the data matrix $X_i$, we include controls for institutional ownership, size, book-to-market, and momentum.

Model 1 in Panel A of Table VIII reports the impact of abnormal short interest on the time to exposure. We report results using $ABSI(1)$, although the results are similar using $ABSI(2)$ and $ABSI(3)$. The coefficient is $-0.028$ and is statistically significant, indicating that short selling is associated with a more rapid exposure of the misconduct. In Models 2 to 5, we include controls for the severity of the misconduct. The coefficients for *Fraud* in Model 2 and for *Total accruals* in Model 4 both are negative and statistically significant, consistent with the view that severe misrepresentations are discovered relatively quickly. These results continue to hold in Model 5, which includes all three severity measures together. Most importantly for our investigation, the coefficient for abnormal short interest is negative and significant in all model specifications. This implies that short selling is positively related to the speed with which financial misrepresentation is uncovered.

The coefficient estimates from the parametric log-logistic model allow us to quantify how abnormal short interest affects the time until misrepresentation is discovered. Consider short interest in firms whose violations have been ongoing for 12 months. Using the Model 5 estimates and inserting mean values for all other variables, a firm at the 75$^{\text{th}}$ percentile of abnormal short interest eventually will have its misconduct uncovered 8 months sooner than a firm at the 25$^{\text{th}}$ percentile. As reported in Table I, the median time-to-revelation is 26 months, so an 8-month reduction in the time to revelation represents a significant impact of short selling on the time it takes to uncover the misconduct.

### *B.2. Endogeneity*

Table V shows that short sellers take particularly large positions when the misrepresentation is particularly egregious. Suppose that egregious

[14]We obtain qualitatively identical results using a discrete version of Cox's (1972) semiparametric proportional hazard model. The Cox model requires no assumption about the distribution of $\varepsilon_i$ in equation (7). An advantage of the parametric specification, however, is that it enables us to obtain quantitative estimates of the impact of short selling on the time to revelation, as reported below.

misrepresentations are discovered quickly, not due to short selling, but rather because their severity prompts a fast response from investors or regulators. In this case, we would not conclude that short interest accelerates the time to discovery, but rather that both short interest and time-to-discovery are driven by the severity of the misconduct.

This concern is mitigated somewhat by including measures of misconduct severity in the empirical tests, as in Panel A of Table VIII. The severity measures, however, may be imperfect. To further control for a possible omitted

**Table VIII**
**Short Selling and the Public Exposure of Financial Misrepresentation**

This table reports the coefficients estimates and corresponding $p$-values for the following parametric survival model:

$$\log(M_i) = \beta' X_i + \varepsilon_i.$$

$M_i$ is the month in which firm $i$'s misconduct is revealed to the public. The regression is estimated using data from all months in the violation period through the month of public revelation. $X_i$ includes variables that are likely to affect the exposure of misconduct, most importantly, abnormal short interest. The error term is assumed to follow a logistic distribution. The sample includes all misrepresentations for which data are available over the period 1988 to 2005. Panel A reports the results using the first measure of abnormal short interest, *ABSI*(1). Results are similar using the alternate measures of abnormal short interest, *ABSI*(2) and *ABSI*(3). Panel B reports results using instrumental variables for each of the three different measures of abnormal short interest. Variables are defined as in Tables IV and V.

Panel A: Direct Tests (Using *ABSI*(1) to Measure Abnormal Short Interest)

| | Model | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Abnormal short interest (ABSI(1)) | −0.028 | −0.025 | −0.028 | −0.026 | −0.023 |
| | (< 0.001) | (< 0.001) | (< 0.001) | (< 0.001) | (< 0.001) |
| Fraud | | −0.323 | | | −0.480 |
| | | (< 0.001) | | | (< 0.001) |
| Insider trading charges | | | −0.008 | | 0.122 |
| | | | (0.91) | | (0.13) |
| Total accruals | | | | −0.228 | −0.197 |
| | | | | (0.05) | (0.07) |
| Institutional ownership | −0.0003 | −0.0001 | −0.0003 | −0.0001 | 0.001 |
| | (0.85) | (0.92) | (0.85) | (0.96) | (0.44) |
| Size | 0.023 | 0.012 | 0.023 | 0.024 | −0.004 |
| | (0.16) | (0.47) | (0.16) | (0.19) | (0.83) |
| Book-to-market ratio | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| | (0.001) | (0.002) | (0.001) | (0.002) | (0.003) |
| Momentum | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| | (0.05) | (0.03) | (0.05) | (0.05) | (0.04) |
| Intercept | 4.945 | 5.193 | 4.947 | 4.899 | 5.263 |
| $N$ | 8,902 | 8,902 | 8,902 | 7,160 | 7,160 |

(*continued*)

**Table VIII**—*Continued*

Panel B: Instrumental Variable Tests

| | Abnormal Short Interest | | |
|---|---|---|---|
| | *ABSI*(1) | *ABSI*(2) | *ABSI*(3) |
| Instrumental variable for ABSI(j) | −0.261 | −0.206 | −0.158 |
| | (0.00) | (0.00) | (0.00) |
| Fraud | −0.485 | −0.594 | −0.540 |
| | (0.00) | (0.00) | (0.00) |
| Insider trading charges | 0.099 | 0.163 | 0.154 |
| | (0.20) | (0.05) | (0.08) |
| Total accruals | −0.490 | −0.524 | −0.592 |
| | (0.00) | (0.00) | (0.00) |
| Institutional ownership | 0.0020 | 0.0010 | 0.0008 |
| | (0.11) | (0.46) | (0.59) |
| Size | 0.052 | 0.032 | 0.038 |
| | (0.00) | (0.07) | (0.04) |
| Book-to-market ratio | −0.0068 | −0.0106 | −0.0096 |
| | (0.57) | (0.42) | (0.48) |
| Momentum | 0.0015 | 0.0019 | 0.0017 |
| | (0.00) | (0.00) | (0.00) |
| Intercept | 4.732 | 4.986 | 4.974 |
| *N* | 4,922 | 4,922 | 4,922 |

variables bias in estimating equation (7), we construct an instrumental variable for short interest. The instrumental variable is the fitted value from the following cross-sectional model, which is estimated for each month $t$:

$$ABSI(j)_{it} = \delta_{0t} + \delta_{1t} Options_{it} + \varepsilon_{it}, \quad j = 1, 2, 3. \tag{8}$$

In equation (8), $Options_{it}$ is a dummy variable set equal to one if the stock has listed options on the CBOE in month $t$. Diether, Malloy, and Scherbina (2002) find that short selling activity is positively related to the availability of options markets trading. This is for two reasons. First, listed options can decrease the cost of hedging short positions. And second, firms with listed options may be less expensive to borrow and sell short since stocks with options tend to be larger and more liquid. Consistent with such prior findings, we find that the mean of the cross-sectional coefficients $\hat{\delta}_{1t}$ in equation (8) is positive and significant using all three measures of abnormal short interest. Using coefficient estimates $\hat{\delta}_{0t}$ and $\hat{\delta}_{1t}$ from equation (8), we create an instrumental variable equal to the fitted value $\widehat{ABSI(j)}_{i,-1}$.[15]

[15]In most tests, $\widehat{ABSI(j)}_{i,-1}$ satisfies the exclusion restriction for an instrumental variable, as it is not significantly correlated with the residual in the time-to-revelation models. An exception is Model 2 in Panel B of Table VIII, for which the instrument is significantly correlated with the residual. For discussions of instrumental variable tests with hazard models, see Abbring and Van den Berg (2005) and Bijwaard (2008).

Panel B of Table VIII reports the results of the instrumental variable estimation. We use the same specification as in Model 5 of Panel A, except that we replace $ABSI(j)_{i,-1}$ with the instrumental variable $\widehat{ABSI(j)}_{i,-1}$. Using any of the three measures, the coefficient for the instrumental variable is negative and statistically significant ($p < 0.001$). This relation is robust to controls for the severity of the misrepresentation, which also are positively related to the speed with which misrepresentation is uncovered.

The evidence from both Panels A and B in Table VIII indicates that short sellers play an important role in helping to uncover financial misrepresentation. These results are contrary to the estimates by Dyck et al. (2010), which imply that short sellers play only a modest role in helping to unveil business misconduct.

### *C. External Effects of Short Selling on Prices and Share Quantity*

In addition to impacting the time to revelation, short selling can affect share prices and the number of shares held by other investors. Uninformed investors can benefit if short selling keeps prices closer to their full-information values. But they also can be harmed by the extent of short sellers' profits.

Figure 3 illustrates these two external effects. In the figure, $P_{actual}$ represents the price at which shares trade in any given month $t$ during the violation period. In the absence of informed short selling, the inflated price presumably would have been higher, $P_{high}$. The difference, $P_{high} - P_{actual}$, represents short sellers' price impact. When uninformed investors trade with each other, the net distributional effect of the price impact is zero. But when uninformed investors buy from informed sellers, the price impact conveys an external benefit, which is illustrated by Area B (for "Benefit") in Figure 3. We consider trades with two types of informed sellers: insiders and the firm itself. Area B equals the price impact, $P_{high} - P_{actual}$, times the net number of shares sold by insiders or issued by the firm in month $t$. It is a measure of uninformed investors' savings when they buy from informed parties—insiders or the firm itself—who are most likely to gain from the artificial inflation in share prices that occurs when the firm issues falsified financial statements.

Short sellers also impose external costs on uninformed investors. Borrowing shares to sell short increases the number of shares held by uninformed investors.[16] Uninformed investors buy these shares during the violation period, when the shares typically are overpriced. In Figure 3, $P_{true}$ is the value that would obtain if the firm's financial statements were not in error. Every short sale occurs at a price that is inflated by the amount $P_{actual} - P_{true}$. The total external cost to uninformed investors, represented by Area C (for "Cost"), equals $P_{actual} - P_{true}$ times the number of shares sold short.

[16]For a discussion, see Apfel et al. (2001). Apfel et al. also point out that, because it increases the number of shares held long, short selling makes it difficult to identify which shareholders have standing to sue in 10b-5 class action lawsuits for financial fraud. This is a potential cost of short selling that our tests do not measure.

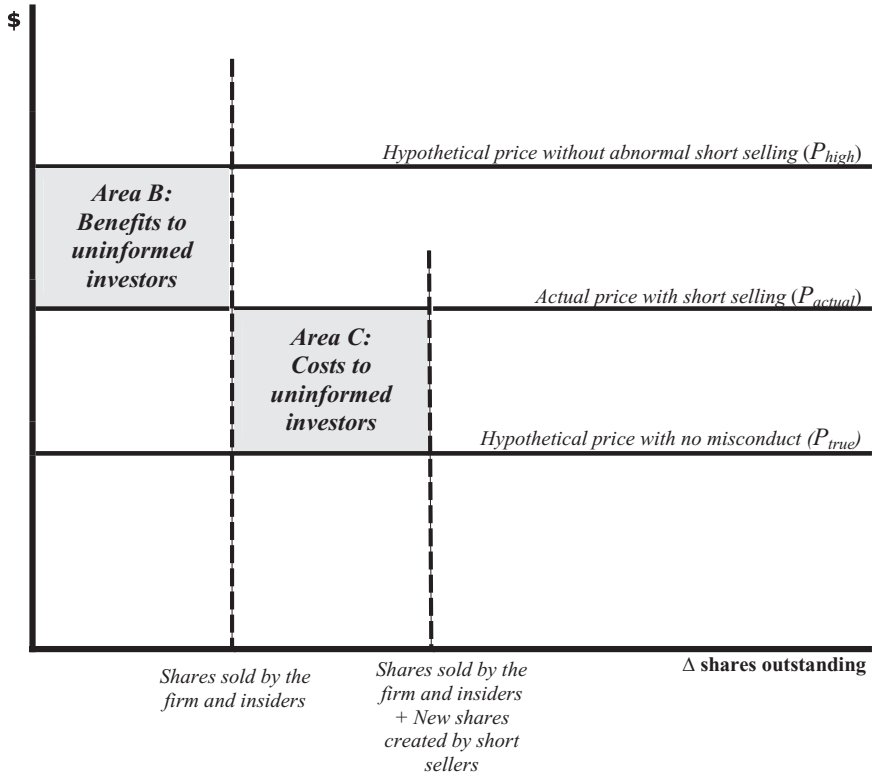


**Figure 3. External effects of short sellers on uninformed investors.** This figure illustrates two external effects of short sellers on uninformed investors during a period in which the firm's financial statements are in error. The top line ($P_{high}$) represents the hypothetical price at which shares would trade in a given month $t$ if there was no abnormal short selling. It is calculated using a model of monthly share returns with an additional regressor that estimates the marginal impact on monthly returns from abnormal short interest. The middle line ($P_{actual}$) represents the observed price in the month. The bottom line ($P_{true}$) represents the hypothetical price at which shares would trade if there was no financial misconduct (or abnormal short selling). *Shares sold by the firm and insiders* is the net change in the number of outstanding shares in month $t$ plus the net number of shares sold by insiders in month $t$. *New shares created by short sellers* is the net change in abnormal short interest. Area B represents the external benefits to uninformed investors because abnormal short interest dampens the price inflation during the misconduct period. Area C represents the external cost to uninformed investors due to the additional shares created by short selling, and equals short sellers' profit.

Notice that Area C represents short sellers' gain. If Area C equals Area B, short sellers internalize their external benefits exactly. If B is positive but less than C, then short sellers generate external gains for uninformed investors, but these gains are more than offset by their profits. If B is greater than C, then short sellers generate external gains that exceed their profits.

To estimate Areas B and C, we need estimates of $P_{high} - P_{actual}$ and $P_{actual} - P_{true}$. For $P_{high}$, we first estimate a cross-sectional model for share returns, $ret_{it}$,

using firms not in the SEC enforcement action sample:

$$ret_{it} = \beta_0 + \beta_1 Size_{i,t-1} + \beta_2 BTM_{i,t-1} + \beta_3 Mom_{i,t-1} + \sum_{k=1}^{K} Ind_{ik,t-1} + \beta_4 ABSI(j)_{i,t-1} + \varepsilon_{it}. \quad (9)$$

Equation (9) is estimated for each month $t$, and the explanatory variables are measured at the end of the prior month, $t-1$. The key to this model is the inclusion of abnormal short interest, $ABSI(j)_{i,t-1}$. The mean estimate $\hat{\beta}_4$ is negative, indicating that short selling does indeed have an impact on prices. Using $ABSI(1)$, for example, the mean of the monthly coefficients $\hat{\beta}_4$ is $-0.091$ with a $t$-statistic of $-10.52$.

The hypothetical return if abnormal short interest were zero, $ret_{it}^{high}$, is

$$ret_{it}^{high} = r_{it} - \hat{\beta}_4 ABSI(j)_{i,t-1}. \quad (10)$$

For each firm-month, we calculate the hypothetical cumulative return, $cumret_{it}^{high}$, from the beginning of the violation:

$$cumret_{it}^{high} = \sum_{\tau=1}^{t} (1 + ret_{i\tau}^{high}). \quad (11)$$

The hypothetical stock price, $P_{high}$, is then calculated as $P_0 * cumret_{it}^{high}$, where $P_0$ is the stock price at the beginning of the violation period. In measuring $P_0$, we adjust for stock splits using the cumulative adjustment factor provided by CRSP. The difference between $P_{high}$ and the actual price at the end of the contemporaneous month is given by $P_{high} - P_{actual}$.

We use two estimates of $P_{actual} - P_{true}$. Our upper bound estimate equals the actual price in month $t$ minus the price per share immediately after the misconduct is revealed. Our lower bound estimate equals 24.53% of this difference. The rationale for the upper bound estimate is that the post-revelation price reflects investors' valuation after they adjust for the news that the price previously had been inflated by falsified financial statements. The rationale for the lower bound estimate is that, as Karpoff et al. (2008b) report, the post-revelation share price falls more than the price inflation that we can attribute to the misconduct. The price drop also reflects investors' expectations of future legal penalties and the firm's reputation loss. Karpoff et al. (2008b, p. 600) estimate that 24.53% of the price drop represents the amount by which prices were inflated by the financial misrepresentation.

We use these variables to calculate Areas B and C for each month of the violation period as a percentage of the firm's market capitalization. For each firm, we sum the monthly estimates of Area B to obtain a firm-specific estimate of short sellers' external benefits. Similarly, we sum the monthly estimates of Area C to obtain a firm-specific estimate of short sellers' profits, which also is a measure of the external costs imposed on uninformed investors.

**Table IX**

## Short Sellers' External Effects on Uninformed Investors

This table reports estimates of the external benefits and costs for uninformed investors from short sellers' trading during the period that the firms' books were in error, using *ABSI*(1) to measure abnormal short interest ($N = 359$). *% Shares sold by the firm and insiders* is the net change in shares outstanding plus net insider sales, expressed as a percentage of shares outstanding at the beginning of the month, and cumulated over all months of the violation period. *Short sellers' price impact,* $P_{high} - P_{actual}$, is the difference between the hypothetical price in the absence of abnormal short interest and the actual month-end price, expressed as a percentage of the actual share price at the beginning of the month. *External benefit* is the sum of the monthly estimates of Area B in Figure 3. Each monthly estimate equals the product of *% Shares sold by the firm and insiders* and *Short sellers' price impact*, and is expressed as a percentage of the firm's equity value. *% New shares created by short sellers* is the increase in *ABSI*(1) from the prior month, expressed as a percentage of shares outstanding at the beginning of the month, and cumulated over all months of the violation period. *Short sellers' profit per share,* $P_{actual} - P_{true,}$ is the difference between the actual price and the price when news of the misconduct is first revealed to the public, expressed as a percentage of the actual share price at the beginning of the month. *External cost* is the sum of the monthly estimates of Area C in Figure 3. It equals the product of *% New shares created by short sellers* and *Short sellers' profit per share. Net external effect* is the difference between *External benefit* and *External cost*. Each variable is measured in each month of a firm's violation period, and summed over all violation period months. The table reports the mean and median of the cross section of firm-specific measures and, in brackets, the 95% confidence interval for the mean. *t*-statistics and confidence intervals are computed from the cross section of firm-specific measures.

| | Mean [95% Conf. Interval] | Median |
|---|---|---|
| External benefit | | |
| % Shares sold by the firm and insiders | 45.65 [26.24, 65.06] | 8.34 |
| Short sellers' price impact, $P_{high} - P_{actual}$ (% of share price) | 2.41 [1.61, 3.21] | 0.22 |
| External benefit (sum of monthly estimates of Area B) | 1.67 [0.25, 3.09] | 0.00 |
| External cost (=short sellers' profits) | | |
| % New shares created by short sellers | 1.12 [0.54, 1.70] | 0.08 |
| Short sellers' profit per share, $P_{actual} - P_{true}$ (% of share price) | 12.13 [2.35, 21.91] | 30.44 |
| External cost (sum of monthly estimates of Area C) | 0.58 [−0.05, 1.21] | 0.08 |
| Net external effect (sum of monthly Area B – Area C) | | |
| Main estimate | 1.09 [−0.80, 2.98] | –0.06 |
| Using a lower-bound estimate of external cost | 1.53 [0.01, 3.05] | 0.00 |

Table IX reports on the resulting estimates using *ABSI*(1) to measure abnormal short interest. Estimates using *ABSI*(2) and *ABSI*(3) are in the Internet Appendix. During the violation period, insiders and the firm jointly sell shares that average 45.65% of the firm's outstanding common stock, with a 95% confidence interval of [26.24%, 65.06%] (the *t*-statistic is 4.61). The time-series

mean of short sellers' monthly price impact, expressed as a percentage of the beginning-of-month share price, is 2.41%. Together, these imply that short sellers' external benefit to uninformed investors—the sum of the monthly measures of Area B—is 1.67% of the firm's market capitalization (95% confidence interval of [0.25%, 3.09%]).

Note that the median values are much smaller. The quantity distribution is skewed right, as a small number of firms issue a large number of shares. The distribution of price impact also is skewed right, and for the median firm, short sellers' external benefit is negligible. Thus, short sellers generate external benefits, on average. But these benefits are negligible for the median firm. Further examination reveals that the right skew in the distribution of external benefits reflects a small number of firms that issued stock during their violation periods, including Cendant Corp., Waste Management Inc., Triton Energy Corp. America Online, Inc., and Royal Ahold NV.[17]

Panel A also reports on short sellers' profits. During the violation period, the average change in $ABSI(1)$ is 1.12% of outstanding shares (confidence interval of [0.54%, 1.70%]), and our upper bound mean estimate of $P_{actual}$–$P_{true}$ is 12.13% of share value per month. Averaging across firms, short sellers' mean profit is 0.58% of the firm's market capitalization. That is, short sellers cumulatively generate profits on the positions they take during the violation period that average 0.58% of the firm's equity value.

The mean net effect, equal to the sum of the differences between each firm's monthly estimates of Areas B and C, is 1.09% of equity value. Note, however, that the confidence interval [−0.80, 2.98] indicates that this estimate is noisy. Furthermore, the median value is negative, albeit small in magnitude (−0.06% of equity value). This indicates that, for most firms, short sellers internalize their external benefits via their trading profits, generating no net external benefits for shareholders. But in a small number of firms, short sellers' net external benefits are positive and large. The net external benefits in these relatively few cases are large enough to generate a positive mean estimate of the external benefit.

If we use the lower bound estimate of short sellers' external costs, the net external benefit is larger. The lower bound estimate of external costs is 0.14% of equity value, increasing the mean estimate of short sellers' net external benefits to uninformed shareholders to 1.53% of equity value (confidence interval of [0.01, 3.05]). This larger estimate of net benefits is appropriate if we think of $P_{true}$ as the price that would have obtained if the firm had never misrepresented its financials in the first place, that is, if we exclude from the definition of $P_{true}$ any legal penalties and reputation losses that accrue to firms that misrepresent their financials.

These results indicate that short sellers generate external benefits for uninformed investors, which in the median case they internalize with their trading

[17]This finding is consistent with arguments that one reason firms misrepresent their financials is to issue new shares at a favorable price (e.g., see Dechow et al. (1996), Efendi, Srivastava, and Swanson (2007)).

profits. For a small number of firms, however, the external benefits are large enough to affect the overall mean estimates. Short sellers generate net external benefits particularly when they take positions in misrepresenting firms that issue new (overpriced) shares to uninformed investors.

## V. Conclusions

Short sellers attract a lot of attention. They are blamed for manipulating and depressing share values, and for exacerbating price declines when bad news is announced. They also are credited with improving financial markets' informational efficiency. We provide evidence on one aspect of short sellers' effects on markets by examining short selling before the public revelation that firms misrepresented their financial statements. Such revelations are material events, as they are associated with an average 1-day share price decline of 18%. Short sellers anticipate such announcements, as abnormal short interest builds steadily in these stocks during the 19-month period before the public revelation. The amount of short selling increases with the severity of the misrepresentation, indicating that short sellers are sensitive to the characteristics of the misconduct. High short interest also concentrates in firms that misrepresent their financials, compared to firms that do not.

These results imply that short sellers are proficient at identifying financial misrepresentation before the general investing public. Our measures of abnormal short interest control for firm characteristics that are known to correlate with (and possibly motivate or facilitate) short selling, including firm size, the book-to-market ratio, momentum, share turnover, institutional ownership, insider trading, and total accruals. But short sellers do not merely track such firm characteristics. Rather, their positions appear also to be based on private information or a superior synthesis of public information about whether firms are cooking their books.

We also examine short sellers' external effects on other investors. Contrary to some claims (e.g., see Wilchins (2008), Zarroli (2008)), short selling does not exacerbate the decline in share prices when bad news is announced. To the contrary, short selling conveys external benefits to uninformed investors, in two ways. First, short selling increases the speed with which financial misrepresentation is detected. Among firms that have been misrepresenting their financials for 12 months, our point estimates indicate that a firm at the $75^{th}$ percentile of abnormal short interest will be publicly revealed 8 months sooner than a firm at the $25^{th}$ percentile. Thus, short selling not only anticipates financial misconduct; it also helps expose the misconduct.

The second external benefit is that short selling mitigates the mispricing that occurs when firms misrepresent their financial statements. This price impact conveys offsetting benefits and costs to uninformed investors who trade with each other. But for uninformed investors who purchase shares from insiders or the firm, the benefits can be substantial. We estimate that this benefit averages 1.67% of the firm's market capitalization. Short sellers internalize some of this benefit, profiting by 0.58% of the firm's equity value, on average. Net of this

profit, short sellers' net external benefit is still positive, averaging 1.09% of the firm's equity value.

These results indicate that short sellers tend to ferret out and help uncover financial misconduct by corporate managers. Short sellers profit from their positions in firms whose misconduct subsequently is revealed. Yet, even net of these profits, short sellers generate external benefits for uninformed investors. By improving market efficiency through its effects on prices, short selling offsets some of the harm imposed on uninformed investors who unwittingly buy shares from firms and insiders while the firm's books are in error.

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