The good news in short interest

Ekkehart Boehmer
Lundquist College of Business
University of Oregon
&
Mays Business School
Texas A&M University

Zsuzsa R. Huszár
College of Business Administration
California State Polytechnic University—Pomona
&
School of Business
National University of Singapore

Bradford D. Jordan*
Gatton College of Business and Economics
University of Kentucky

This draft: April 23, 2009

Journal of Financial Economics, forthcoming 2009.

Abstract

We study the information content in monthly short interest using NYSE-, AMEX-, and NASDAQ-listed stocks from 1988 to 2005. We show that stocks with relatively high short interest subsequently experience negative abnormal returns, but the effect can be transient and of debatable economic significance. In contrast, we find that relatively heavily traded stocks with low short interest experience both statistically and economically significant positive abnormal returns. These positive returns are often larger (in absolute value) than the negative returns observed for heavily shorted stocks. Because stocks with greater short interest are priced more accurately, our results suggest that short selling promotes market efficiency. However, we show that positive information associated with low short interest, which is publicly available, is only slowly incorporated into prices, which raises a broader market efficiency issue. Our results also cast doubt on existing theories of the impact of short sale constraints.

JEL classification: G12; G14
Keywords: short sales; short interest; short sale constraints; market efficiency

---

* Contact author: Brad Jordan; Gatton College of Business and Economics; University of Kentucky; Lexington, KY 40506; 859.257.4887; bjordan@uky.edu. We are indebted to an anonymous referee for his efforts to improve the paper. We also thank Nicolae Gârleanu (2008 AFA discussant), Chris Lundblad (2008 FMA discussant), Jon Fulkerson, Glenn Pettengill, and Themis Pantos for their constructive and helpful comments.

The good news in short interest

1. Introduction

On any given day, there are many relatively large and liquid stocks that could be easily and cheaply shorted, but nonetheless have few or no shorted shares (i.e., little or no short interest). The short interest in a stock is often viewed as a measure of heterogeneity of investor opinion. If this is the case, an easily shorted stock that is completely avoided by short sellers suggests unanimity among market participants that the stock is, at a minimum, not overvalued. An additional implication is that short sellers do not possess significant private negative information about the stock.

Unlike previous studies on short selling, our goal in this paper is to investigate whether the absence of short selling is informative about future returns. Using NYSE, AMEX, and NASDAQ short interest data from 1988 through 2005, we find that portfolios of lightly shorted stocks have economically large and statistically significant *positive* abnormal returns. These returns are often larger (in absolute value) than the negative returns on portfolios of heavily shorted stocks, and they are robust to issues such as portfolio weighting, the timing of portfolio formation, the risk-adjustment procedure, listing venue, and the inclusion/exclusion of recent new listings or the 1998-2000 period.

Our results have significant implications for well-known models of the impact of short sale constraints on asset prices such as Miller (1977), Diamond and Verrecchia (1987), and Hong and Stein (2003). In these models, short sale constraints inhibit the incorporation of negative information in stock prices, but, because there are no constraints to going long, there is no such barrier to the incorporation of positive information or opinion. This assumption is central in, for example, Hong and Stein's (2003) explanation of why markets melt down, but don't melt up.

However, our results show that both positive and negative information apparently known to short sellers is not incorporated in stock prices, casting doubt on the critical asymmetry between the way good and bad news is revealed to market participants.

Overall, we find evidence that short sellers are able to identify overvalued stocks to sell and also seem adept at avoiding undervalued stocks. Of course, our results raise the broader question of why prices only slowly adjust to reflect information from public short interest data, thereby joining a growing list of related anomalies. We have no explanation for this apparent market efficiency failure, but we can observe that the powerful "barriers to arbitrage" argument of Shleifer and Vishny (1997) does not seem to apply because the abnormal returns we identify can be captured by simple buy-only strategies.

The remainder of this paper proceeds as follows. Section 2 reviews the relevant short sale literature. Section 3 presents the data. Section 4 discusses the research methods and the baseline results. Section 5 presents additional analyses and robustness results. Section 6 concludes.

2. Background

On the theory side, the literature on short selling focuses primarily on the implications of short sale constraints when investors have heterogeneous beliefs and/or information. In essence, binding short sales constraints inhibit the incorporation of negative information in prices. But, because there is no barrier to going long, positive information is not withheld. In Miller (1977), the result is that stock prices are on average too high because stocks tend to be held by those investors with overly positive views. In a recent review, Rubinstein (2004) traces this argument to Williams (1938), and he refers to it as the Williams-Miller hypothesis. Hong and Stein's (2003) model is similar in spirit, and they show how binding short sale constraints can promote market crashes and can also explain various observed features of crashes such as the fact that they sometimes occur in the absence of sufficiently significant new public information.

In Diamond and Verrecchia (1987), the effect is more subtle. Rational investors are aware that, due to short sale constraints, negative information is withheld, so individual stock prices reflect an expected quantity of bad news. Prices are correct on average in the model, but individual stocks can be overvalued or undervalued. Two more recent studies, one with a theoretical model (Gallmeyer and Hollifield, 2008) and one with a series of experiments (Haruvy and Noussair, 2006), show that short sale constraints can cause both overvaluation and undervaluation.

Empirical research on short selling has historically focused on the information content in short interest (or the change in short interest) as measured by the short interest ratio (SIR), which is a monthly snapshot of the percentage of outstanding shares sold short. There are three competing and contradictory arguments. The first one, often attributed to conventional Wall Street wisdom (Epstein, 1995), is that short interest represents future demand because of position-closing, so a relatively high short interest is a bullish signal. At the other extreme, if, as in Figlewski (1981), heavy shorting represents wide dispersion of beliefs, then the Williams-Miller hypothesis suggests that stocks with a high SIR might be overvalued. Finally, Brent, Morse, and Stice (1990) note that short selling can arise for a variety of reasons. Arbitrage operations involving convertible bonds, options, pending mergers, and indexes are some examples. Other reasons include hedging, tax-related trades, and relative value trades. None of these reasons is necessarily related to investor opinion about overvaluation, so there is no reason to believe that the SIR would be informative about future returns.

Overlaying these arguments is a basic market efficiency question. The short interest data used in most studies is public and available on a monthly basis. Nonetheless, early studies such as Seneca (1967) and Figlewski (1981) find evidence that stocks with high short interest subsequently underperform. More recent studies such as Asquith and Meulbroek (1995) and Desai, Ramesh, Thiagarajan, and Balachandran (2002) also find that high SIR stocks have significant negative abnormal returns. Similarly, Senchack and Starks (1993) find that stocks with large increases in short interest underperform, particularly those that do not have exchange traded options (the presence of which would presumably reduce the impact of short sale constraints).

In other recent research, short interest has been studied in conjunction with measures that attempt to identify stocks subject to short sale constraints or wide divergence of opinion. Chen, Hong, and Stein (2002) use mutual fund holdings as a proxy for breadth of ownership (and thus availability of the stock in the lending market). They find that reductions in breadth are associated with lower future returns. Boehme, Danielsen, and Sorescu (2006) use a variety of measures for heterogeneity of investor opinion (e.g., analyst recommendations, return volatility) and find strong support for Miller's hypothesis on how short sale constraints simultaneously with divergence in opinion are linked to overpricing.

Other recent studies explore the relationship between shorting and subsequent performance. Asquith, Pathak, and Ritter (2005) find that stocks with high SIR and low institutional ownership (and thus potentially harder to locate) underperform in equal-weighted portfolios, but the underperformance essentially vanishes when value-weighting is used. Using proprietary data, Boehmer, Jones, and Zhang (2008) examine daily short sale flow executed at the NYSE over the period January 2000 through April 2004. They find that heavily shorted stocks significantly underperform lightly shorted ones (over a 20-day holding period), and they argue that the difference far exceeds trading costs. However, as they stress, their data are not available to the public, so their reported excess returns are suggestive of the returns to short sellers but do not present a market efficiency problem. Diether, Lee, and Werner (2008) use tick data on all short sales executed in the U.S. in 2005 (these data have been available only since January 2, 2005). They too find that portfolios long lightly shorted stocks and short heavily shorted ones have positive abnormal returns, though the amount of trading required to capture the returns would be considerable.

Boehmer et al. (2008) report that short selling accounts for about 13% of overall NYSE trading volume and that this percentage is similar across market capitalization groups. Boehmer et al. (2009) show that this fraction increases to more than 40% by 2007. These percentages are much higher than the monthly short interest data would suggest. The reason is that short positions are on average much shorter-lived than long positions. Using data from 2005, Diether et al. (2008) report that short sales represent 32% of NASDAQ volume. Also using data from 2005, Asquith, Oman, and Safaya (2008) similarly find that short sales account for 30% of all trades and 28% of volume. Clearly, short selling is very common, suggesting that costs and other constraints are not particularly binding.

Other studies such as D'Avolio (2002), Cohen, Diether, and Malloy (2006), and Geczy, Musto, and Reed (2002) study proprietary data on rebate rates. These studies generally indicate that relatively few stocks are on special (difficult to borrow) at any given time. Asquith et al. (2005) report that institutional ownership exceeds short interest for 95% of their sample, again indicating that locating shares to borrow is not likely to be difficult. Taken together, these studies indicate that short sale constraints are in general not as economically significant as academic researchers once believed.

Our study differs from earlier work. To our knowledge, we are the first to focus closely on lightly shorted stocks. Why would a given stock have little or no short interest? One obvious potential reason is that short selling is highly (or even completely) constrained. If this is correct, then based on previous studies such as Chen et al. (2003) and Boehme et al. (2006), we might expect such stocks to significantly underperform once prices incorporate short sellers' information.

Alternatively, if short sale constraints are not binding, then the absence of short interest means (by definition) that short sellers are avoiding the stock. Short sellers will avoid a stock if their private valuation is equal to or higher than the market price. In this case, the absence of short selling may be an indicator of private good news. Our results, which we begin to explore next, are consistent with this notion, but we show that, for some reason, positive information reflected by the absence of short interest is only slowly incorporated into prices.

3. Data

We examine monthly short interest from June 1988 to December 2005 in stocks listed on NYSE, AMEX, and NASDAQ. We extract data on monthly returns, monthly trading volumes, end-of-month prices, and the number of shares outstanding from the Center for Research in Security Prices (CRSP) monthly files. We obtain company-specific financial information from the Compustat annual industrial files. We limit our analysis to domestic common stock (CRSP share codes 10 and 11) and require that a stock be seasoned in the sense that it has been listed for at least one year, thereby excluding IPOs and other new lists. No other restrictions apply.[1]

We use CUSIPs and tickers from the TAQ master files and, when necessary, company names to match the different data sets. We exclude observations where data are missing on the monthly return, trading volume, shares outstanding, or share price. We also exclude stocks trading on a when-issued basis. The final sample consists of 930,109 stock-month observations, of which 634,583 are from NASDAQ, 285,541 from NYSE, and 9,985 from AMEX. On average, we have about 4,400 different firms per month. To avoid lookahead bias (and also to consider the observation in Desai et al. (2002) that short interest is exceptionally high in delisting stocks), we include stocks that delist and use the CRSP-supplied delisting return as needed.[2]

[Figure 1 about here]

Figure 1 describes the time series of shorting activity and illustrates the growing importance of short selling in equity markets. We present three measures based on reported short interest: the aggregate number of shorted shares, the aggregate short interest ratio (SIR, aggregate shorting as a percentage of total shares outstanding), and the median days-to-cover ratio (SIR divided by share turnover, defined as the ratio of average daily share volume to shares outstanding). We observe an upward trend in all three measures over the sample period. Shorting clearly becomes more prevalent, both in terms of share volume and as a percentage of shares outstanding. The level of short interest and days-to-cover rise at an increased rate after 1999. The days-to-cover ratio is an indicator of how long it takes to cover outstanding shorts. The sharp

---

[1] We obtain the short interest data directly from the respective markets. As noted by previous researchers (e.g., Chen and Singal, 2003), two months, February 1990 and July 1990, are missing from the NASDAQ short interest files. We exclude these two months from all time-series graphs.

[2] Excluding stocks that delist during our sample period leaves our results qualitatively unchanged.

increase in the later years of our sample suggests that shorting also grew relative to overall trading volume.

We are particularly interested in lightly shorted stocks. As shown in Figure 2, the percentage of stocks with less than 0.1% short interest declined from over 52% to about 15% over our sample period. We also show the percentage of stocks with less than 0.1% short interest in the top and bottom market cap quartiles. The general trend is apparent for both subgroups, but it is clear that larger stocks are less likely to have low short interest. These results look almost identical when we use the highest and lowest turnover deciles (not shown).

[Figure 2 about here]

4. Research methods and empirical results

4.1 Research methods

Historically, short interest data have been published in *The Wall Street Journal* on a monthly basis.[3] As in other studies, such as Desai et al. (2002), we test for abnormal returns during the calendar month following publication. Specifically, at the beginning of each month, we create portfolios of lightly shorted and heavily shorted stocks (as measured by the SIR) based on the previous month's short interest reports. We use the four-factor model of Fama and French (1993) and Carhart (1997) to test for monthly abnormal returns on these portfolios as follows:

$$R_{port\ t} - Rf_t = a_{port} + b_{port}\ RMRF_t + s_{port}\ SMB_t + h_{port}\ HML_t + m_{port}\ MOM_t + e_{port\ t} \qquad (1)$$

The dependent variable in eq. (1), $R_{port\ t} - Rf_t$, is either the monthly equal-weighted or value-weighted excess portfolio return subsequent to the portfolio's creation. $RMRF_t$, SMB_t, HML_t, and MOM_t are the Fama-French and Carhart factor portfolio returns. The intercept captures the

[3] Since September 2007 (after our sample period ends), short interest has been published two times per month.

average monthly abnormal performance. The data for the factor portfolio returns are from Wharton Research Data Services (WRDS).

In our analyses, we report results for both value and equal weighting. It is sometimes argued that value weighting in the context of performance evaluation is preferable because value weights reflect the holdings of the average investor. However, value weighting does not reflect the average investor's net short position (which is zero in all stocks at all times).[4] Further, on the long side, the supply of shares in a particular stock is fixed (at least in the near term). But this is not true for the short interest, which can (and does) change dramatically month to month, particularly for individual stocks. Finally, suppose a heavily shorted stock has persistent negative abnormal returns. In our value-weighted portfolios, it would receive a smaller weight each month, thereby at least partially masking the success of short sellers. For these reasons, it is not clear that value weighting is superior to equal weighting in studying the performance of shorted stocks, and we report both as needed.

4.2 Baseline results

To begin our analyses, we form three highly shorted and three lightly shorted portfolios. The highly shorted portfolios include stocks from the 99^{th}, 95^{th}, and 90^{th} percentiles of the SIR distribution in month *t* - 1. The lightly shorted portfolios include stocks from the 1^{st}, 5^{th}, and 10^{th} SIR percentiles. We estimate eq. (1) for each of the six percentile portfolios and for three long/short portfolios. The long/short portfolios test for significant differences between the 99% and 1% portfolios, the 95% and 5% portfolios, and the 90% and 10% portfolios.

---

[4] The average investor (as opposed to the average short seller) has a zero short position in all stocks in all times because the global wealth portfolio has no short positions (for the same reason that it has no net debt).

During the first few years of our sample period, the percentage of stocks with zero short interest is as high as 20%. To create the 1%, 5%, and 10% portfolios, we first include all zero short interest stocks. We then add additional stocks if needed to reach the particular percentile cutoff. As a result, the low SIR portfolios have more stocks, on average, than the high SIR portfolios, particularly for the 1% - 99% comparison. For the same reason, the 1%, 5%, and 10% portfolios are identical, or nearly so, during the first five years of our sample.

The results from this analysis are reported in Table 1. Panel A uses equal weighting and Panel B uses value weighting. We first just look at raw and excess raw returns. With equal weighting, the 99% SIR portfolio has an average monthly return of -.1%. In contrast, the 1% SIR portfolio earns 2.1% per month, and the difference is significant at any conventional level. The difference is smaller with value weighting, but still highly significant both statistically and economically. Clearly, on average, lightly shorted stocks greatly outperform heavily shorted ones.

[Table 1 about here]

Turning to the Fama-French-Carhart regressions, Panel A shows that the intercepts for the highly-shorted portfolios range from -1.2% per month for the 99% SIR portfolio to -.4% for the 90% SIR portfolio. The intercepts are significant at the 1% level. With value weighting, only the 99% SIR portfolio's abnormal return of -.9% per month is economically or statistically different from zero. Thus, regardless of weighting, the 99% SIR portfolio appears to underperform significantly. However, similar to Asquith et al. (2005), the results for the other heavily-shorted portfolios are sensitive to weighting.

With either weighting scheme, the heavily shorted portfolios have relatively large market betas, a positive coefficient on *SMB,* and a negative coefficient on *HML*. Thus, they resemble small cap growth stocks, at least statistically. They have a significantly negative loading on the momentum factor with equal weighting, but relatively little sensitivity to momentum with value weighting. Our intercept and slope coefficients for the highly shorted stocks are quite similar to those reported by Asquith et al. (2005). For example, for the 99% SIR portfolio with equal weighting, Asquith et al. report (in Panel A of their Table 4) an intercept of -1.25% per month compared to our -1.2% per month. Desai et al. (2002) also report coefficients similar to ours (in their Table 3). However, neither study examines lightly shorted stocks, so no comparison is possible.

The results for the lightly shorted portfolios are more interesting. For the low SIR portfolios in Panel A, the abnormal returns are 1.3 to 1.4% per month with equal weighting and highly significant. At around .5% per month, they are smaller with value weighting, but still highly significant in all cases. Furthermore, regardless of the weighting scheme, the market betas are about .60, so the portfolios have low market risk. They have positive coefficients on *SMB* and *HML*, and the coefficients are similar for the different percentile cutoffs and weightings (which is to be expected to a certain extent given the overlap between the portfolios). Thus, statistically, these portfolios look more like small cap value stocks. The coefficient on *MOM* is negative in all cases, but it is larger (in absolute value) with equal weighting.

The results in Table 1 for the long/short portfolios are notable in several regards. With equal weighting, the monthly abnormal return for the SIR 1% - SIR 99% portfolio is economically large (2.6% per month) and statistically significant. Furthermore, the portfolio has a market beta of -.796, which is also highly significant. In other words, adding this portfolio to an existing holding would boost the returns and simultaneously reduce the market risk. The negative market beta is probably the reason that the abnormal returns actually exceed the raw returns.

With value weighting, the abnormal return is still large and significant for the SIR 1% - SIR 99% portfolio at 1.3%, but it becomes smaller and somewhat less significant in the other two cases. The attenuation in abnormal return comes mostly from the short side. The negative market beta, however, is even more pronounced with value weighting.

At first glance, the relatively low market betas for the lightly shorted portfolios might be attributed to thin trading, but given that we use monthly returns and value weighting, this is not likely. In fact, the estimated market betas are about ten times their own standard errors, so they are measured with relatively high precision. We confirm below that thin trading does not explain the observed abnormal returns.

Taken together, the results in Table 1 point to several tentative findings. First, both the raw and abnormal returns to heavily shorted stocks suggest that these stocks underperform, but the returns are somewhat sensitive to the percentile cutoff used and the use of equal versus value weighting. In contrast, the abnormal returns to lightly shorted stocks are much larger and more significant economically and statistically. Moreover, these returns can be exploited through a buy-only strategy. The most provocative result is the return on the SIR 1% - SIR 99% portfolio. With either weighting scheme, this portfolio has the best of all worlds: a large and highly significant abnormal return and a substantial negative market beta.

The fact that low short interest stocks tend to outperform was noted as far back as Figlewski (1981), but subsequent literature has generally overlooked this aspect of short selling. One exception is Boehmer, Jones, and Zhang (2008), who note the same general tendency in their shorter 2000 - 2004 NYSE sample. But they conclude that the abnormal returns cannot be exploited in a trading strategy because their data on shorting flows are not available in real time. Here, in contrast, we show that the pattern exists using publicly available data for both NYSE-AMEX and NASDAQ over a much longer period.

How persistent are the positive returns on lightly and heavily shorted stocks? Panel A in Figure 3 shows abnormal returns on the 1% and 99% value-weighted SIR portfolios for the first six months after portfolio creation. The surprising result is that the abnormal returns for both portfolios continue over six months (and beyond, actually). In Panel A, the returns on highly shorted stocks appear large relative to those for the lightly shorted stocks. Recall, however, that the lightly shorted portfolio has, on average, more than four times as many stocks (232 versus 45, see Table 1). Panel B shows that indeed the large negative returns on highly shorted stocks are limited to the extreme first percentile. When we look at the most shorted decile, the abnormal returns essentially vanish and certainly do not persist over time. In this sense, the subsequent performance of lightly shorted stocks is much more substantial than that of highly shorted stocks. Clearly, these stocks are either consistently and persistently undervalued or a highly relevant risk factor is missing from the Fama-French-Carhart model.

[Figure 3 about here]

4.3 NYSE-AMEX versus NASDAQ

The results in Table 1 are based on the combined NYSE/AMEX/NASDAQ sample. Tables 2 and 3 replicate the analysis separately for the NASDAQ and NYSE-AMEX samples. As shown in Table 2, the NASDAQ-only abnormal returns are similar to those for the combined sample. This is not too surprising since NASDAQ stocks make up about two-thirds of the sample overall and slightly more of the sample for lightly shorted stocks and heavily shorted stocks.

[Tables 2 and 3 about here]

For the NYSE-AMEX analysis, sample sizes are smaller. The SIR 99% portfolio, for example, contains only 15 stocks on average versus 31 for NASDAQ. Compared to the NASDAQ-only sample, the NYSE-AMEX returns are lower overall. With equal weighting (Panel A), the lightly shorted NYSE-AMEX stocks have significant positive excess returns of .4% per month for the SIR 5% and 10% portfolios. The abnormal return for the SIR 1% portfolio is .3% per month, but it is not significantly different from zero. However, the SIR 1% - SIR 99% portfolio has a large and significant excess return of 2.1% per month and a substantial negative market beta of -.659. With value weighting, abnormal returns to lightly shorted stocks are smaller at .2 - .3% per month and are not significant at conventional levels. The large abnormal return (1.4% per month) and negative beta (-.682) for the SIR 1% - SIR 99% portfolio are still present.

Interestingly, the negative abnormal returns to heavily shorted stocks are more pronounced for the NYSE-AMEX sample. In fact, with value weighting, for the NASDAQ sample, the 90 and 95% SIR portfolios have positive, albeit not significant, abnormal returns. With equal weighting, these portfolios have negative abnormal returns, but they are again not significant. In contrast, for the NYSE-AMEX sample, the abnormal returns to heavily shorted stocks are economically large and statistically significant in all cases other than the value weighted 90% SIR.

Overall, comparison of Tables 2 and 3 shows that the low SIR phenomenon is less pronounced for the NYSE-AMEX sample. In subsequent analyses, we clarify matters by showing that the effect on the exchanges is concentrated in high-turnover and smaller (but not just tiny) stocks. Thus, trading activity and firm size, rather than listing venue, are the important factors.

4.4 Subperiod results

Equity markets experienced a variety of changes over our sample period. For example, short interest, trading volume, and institutional holdings, a proxy for the supply of lendable shares, increased markedly (see our Figure 1 and Boehmer and Kelley, 2009). Further, Asquith et al. (2005) find significant differences between the earlier and later years in their sample. Thus, in this section, we explore whether our results are period-specific and how they vary over time.

First, using the model in equation (1), we estimate abnormal returns for the equal-weighted 10% and 90% SIR portfolios over rolling four-year periods. In Figure 4, we plot the resulting monthly intercept coefficients along with their associated 95% confidence intervals. Several interesting observations emerge. Panel A shows that the abnormal return for the 10% low-SIR portfolio is remarkably stable around 1.5% per month. It is also reliably positive, despite the relatively short 48-month windows. In contrast, the abnormal performance for the 90% high-SIR portfolio in Panel B is much more erratic. It centers around -0.5%, but for most years the point estimates are statistically indistinguishable from zero. This time-series evidence strongly suggests that the abnormal returns to lightly-shorted stocks are not period-specific. In contrast, consistent with Asquith et al. (2005), the abnormal returns to heavily shorted stocks vary substantially over time.[5]

[Figure 4 about here]

We also examine the market betas from the rolling 48-month analysis (not shown). The relatively high beta for the heavily shorted stocks is quite stable, ranging between 1.2 and 1.4

---

[5] The results in Figure 4 are similar if the 1% and 99% SIR portfolios are used instead, particularly for the 1% portfolio. They are therefore not reported to save space, but are available on request.

with a typical standard error of .10. The beta for the lightly shorted stocks ranges from .4 to .8, with typical standard errors in the range .10 to .15. This means that one of the unanticipated results from Table 1, the significantly negative market beta for the long/short portfolio, is surprisingly stable over time.

In additional unreported tests, we split the sample into distinct periods and replicate the analysis for these subperiods. Specifically, we repeat the analysis in Table 1 separately for the periods 1988–1996 and 1997–2005. The results are quite similar for the two subperiods with either weighting scheme.

4.5 Sorts on firm characteristics

In this section, we explore the returns on lightly and heavily shorted stocks in greater depth. Before doing so, we examine firm characteristics for the high and low SIR groups in Table 2. As shown there, the high SIR stocks have a median market cap of $410 million, which is about 14 times larger than the median for the low SIR stocks. The high SIR stocks also have higher prices: a mean (median) stock price of $22.59 ($18.36) compared to $8.62 ($5.30) for the low SIR stocks. Median total sales are eight times larger. Additionally, the high SIR stocks have lower book-to-market ratios; they are more leveraged; and they have lower median (but not necessarily mean) earnings yields and lower mean (but not necessarily median) profit margins. Thus, by these measures, they have weaker fundamentals. Finally, another clear difference is that high SIR stocks are much more intensively traded as measured by share turnover.

[Table 4 about here]

Given that high SIR stocks are larger and more intensively traded, it is conceivable that differential size and liquidity, rather than short interest, are behind the results in our previous section. In principle, the size difference is not an issue because the four-factor model we employ specifically controls for size. However, as described in Fama and French (1993), NYSE decile breakpoints are used in the construction of the *SMB* portfolio, so essentially all of the smaller NASDAQ stocks end up in a single portfolio. Thus, the *SMB* factor may not discriminate well among smaller issues.

We explore the joint effects of size and trading intensity by doing a sequential 4 × 4 × 4 sort on size, then turnover, and then SIR. We use quartiles to keep the number of categories to a manageable number (64) and to ensure that the portfolios have a reasonable number of stocks in them. As before, we place all stocks with zero short interest into the lowest SIR quartile (within their respective size and share turnover quartiles). If more than 25% of stocks have zero short interest, we then divide the remaining stocks into three equally sized groups. We repeat the Fama-French-Carhart analysis of Table 1 within each of the 64 groups. To save space, only the intercepts (the monthly abnormal returns) are reported in Table 5. In Panel A, we examine the entire sample. To verify that our results are not being driven by very small NASDAQ stocks, we repeat the analysis in Panel B using only NYSE-listed stocks. Finally, for completeness, we repeat the analysis using only NASDAQ-listed stocks in Panel C. Because we control for size by grouping, the equal- and value-weighted results are similar. We therefore just report and discuss the value-weighted results. In all three panels, the quartile breakpoints are determined relative to the sample under consideration.

[Table 5 about here]

Beginning with Panel A, we see relatively clear differences across both size and turnover quartiles. Two things are particularly notable. First, the large abnormal returns for low SIR stocks are concentrated in the higher turnover groups, and the effect is pronounced for the three smaller size quartiles. Second, for these same quartiles, the returns for the low SIR portfolios are consistently much larger economically than the returns on the high SIR portfolios across all the turnover quartiles. With the exception of the low turnover category for the smallest stocks, these return differences are highly significant statistically as well.

For the large size quartile, the results are weaker across the board; however, the results in Panel A are not just due to the smallest stocks. For example, in the medium-large size quartile (where all stocks are above the median in size), a portfolio that is long high turnover, low SIR stocks and short high turnover, high SIR stocks has an abnormal return of 1.9% per month.

The large size quartile is, of course, dominated by NYSE securities, so a question arises over whether the large abnormal returns are a NASDAQ-only phenomenon. We address this concern in Panel B, which replicates Panel A after discarding all of the NASDAQ and AMEX stocks. Because we re-sort the stocks, the size breakpoints in Panel B are all much larger than those in Panel A. Roughly speaking, the median market cap in the smallest size quartile in Panel B tends to be about equal to the overall median in Panel A (we say "roughly" because there is considerable variation through time). Also, our sample size declines by 2/3, so the 64 cells contain far fewer securities (and thus have larger standard errors).

With these caveats in mind, Panel B shows that the effect seen in Panel A is not limited to the NASDAQ. For example, in the smallest NYSE-only quartile, we see very large positive abnormal returns to high turnover, low SIR stocks. The abnormal return on the corresponding long/short portfolio is huge at 2.6% per month. Panel B also sheds some additional light on the highly shorted stocks. To the extent that we see significant negative abnormal returns, they tend to be concentrated outside the large size quartile.

The results in Panels A and B are based on the original Fama-French-Carhart factor returns, which are computed using NYSE-only size breakpoints. While our results are clearly present in NYSE-listed stocks, they appear more pronounced in smaller stocks. This raises the potential concern that we are picking up a mismatch between returns on smaller, NASDAQ-listed stocks and factor returns based on NYSE breakpoints. For example, our results might arise because factor sensitivities are somehow correlated with shorting activity. To address this issue, we construct a new set of factors using only NASDAQ-listed stocks (and, thus, NASDAQ size breakpoints), but otherwise calculated identically to the Fama-French-Carhart factors. In Panel C, we use these new factors to adjust the returns of NASDAQ-listed stocks. The results are consistent with our previous inferences. In particular, the alphas for the most shorted portfolios are indistinguishable from zero for eleven of our sixteen portfolios, and are significantly negative for only two portfolios. In contrast, abnormal returns for the least shorted portfolios are, with one exception, positive, and in ten portfolios they are significantly different from zero. Similar to the NYSE-listed stocks in Panel B, for NASDAQ-listed stocks, we also document the most pronounced results for smaller, high turnover portfolios.

Taken together, the results in Table 5 indicate that the positive abnormal returns we find for high turnover, low SIR stocks are not specific to either listing venue, but they are concentrated in stocks other than the very largest. But this only deepens the mystery. Smaller stocks are presumably more difficult and/or expensive to short, so a lack of short interest in such cases might be suggestive of a barrier to short selling. If so, orthodox thinking regarding short constraints clearly suggests that such stocks should not be undervalued. Further, why would the more liquid of such stocks (as measured by turnover) be the most undervalued?

5. Robustness checks

We perform a battery of robustness tests and report the most relevant results in this section.

5.1 Low-priced stocks and the NASDAQ "bubble" period

Table 4 shows that the mean (median) stock price in the bottom SIR decile of our sample is $8.62 ($5.30). This is substantially lower than prices in the most shorted decile, so there may be a concern about the influence of very low stock prices. Also, our study period includes the NASDAQ "bubble period" of 1998-2000, which featured extraordinary stock price increases, particularly in certain industries. To evaluate the effect of cheap stocks and the bubble period, Table 6 replicates Panel A of Table 5 after excluding (1) stocks with end-of-month prices less than $5 and (2) the years 1998-2000 (recall that new lists are already excluded). As with our NYSE-only analysis in Panel B of Table 5, we have re-sorted the stocks, so the median sizes within quartiles are larger than those in Table 5.

[Table 6 about here]

The results in Table 6 continue to show relatively large, positive abnormal returns for low SIR, high turnover stocks, particularly for smaller stocks (and recall that the smallest stocks have now been excluded). An interesting byproduct of this analysis is to sharpen the results on the high SIR stocks. For the smaller three quartiles, the abnormal returns for the highly shorted stocks are significantly negative, both economically and statistically, in the top three turnover quartiles (and in one of the three low turnover quartiles). As a result, many of the hedge portfolio abnormal returns are large and highly significant. In additional analyses (not reported), we have separately considered the effects of low-priced stocks and the NASDAQ bubble, and our conclusions are unaltered.

5.2 Optionable stocks

It is more difficult to create synthetic short positions in stocks without listed options. Moreover, these stocks tend to be relatively small and have low institutional ownership. Both of these observations suggest that stocks without options are more difficult to short than stocks that have options listed. Consistent with this reasoning, D'Avolio (2002) finds that stocks with low institutional ownership and no listed options are more likely to be on special in the equity lending market. Therefore, for these stocks, low short interest could indicate a binding shorting constraint rather than an absence of interest in shorting the stock.

To explore whether this issue affects our conclusions, we replicated Table 2 after excluding stocks with listed options. We obtain information on option listings from two sources. The 1988–1995 portion comes from Sorescu (2000), and the later portion comes from Optionmetrics. For the latter, we consider a stock optionable if both trading volume and open interest are different from zero in a stock-month. Because stocks with listed options tend to be larger, the main effect of excluding optionable stocks on our sample is to eliminate large numbers of NYSE stocks. The overall results (not reported) are quite similar to what is reported in Table 2, so the presence or absence of listed options does not significantly affect our results.

5.3 Regression analysis with lagged factors

In our discussion of Table 1 and Figure 3, we note that the low SIR stocks have a market beta significantly less than one. Furthermore, the regression R^2 values for these stocks (not reported in the table) are approximately .67, which is smaller than what we observe for the high SIR stocks. Both of these observations suggest that thin trading/illiquidity may be a concern, so we replicate Tables 1 and 4 after adding lagged (by one month) Fama-French and Carhart factors as explanatory variables. As expected, the inclusion of lagged factors improves the goodness of fit of our models, particularly for the low SIR stock portfolios, but the magnitude and the significance of the positive abnormal returns on these portfolios remain unchanged.

In these unreported results, we find abnormal returns of 1.4% per month for low SIR portfolios with equal weighting and 0.5% with value weighting. Similarly, in replicating Table 5, the inclusion of lagged market factors does not affect our previous results—abnormal returns on equally weighted, low SIR portfolios still average 1.1% per month in the three highest turnover quintiles. With value weighting, the abnormal returns are economically smaller, but remain statistically and economically significant. Thus, the positive information in low short interest cannot predominantly be attributed to thin trading or illiquidity.

5.4 Momentum and short interest

While we control for returns to a momentum factor in our Fama-French-Carhart analyses, we nonetheless recognize the possibility that momentum may have effects beyond those captured by this model. To explore this issue further, in each month, we first sort stocks into two groups based on whether their returns are above ("winners") or below ("losers") the median return over the previous three months (and, separately, six months). We then repeat the analysis in Table 1.

Briefly, we find that momentum presorting further isolates the effect of short interest for both the lightly and heavily shorted stocks. In both cases, the abnormal returns are noticeably larger for loser stocks, which seems somewhat surprising for the lightly shorted stocks, though perhaps less so for the heavily shorted ones. For the loser stocks, with equal (value) weighting, the abnormal return on the SIR 1% - SIR 99% hedge portfolio is 3.4% (2.1%) per month (with market betas of -.845 and -.822, respectively). With similar market betas, the abnormal returns for the SIR 10% - SIR 90% hedge portfolios are 2.0% and 1.1% with equal and value weighting respectively. As before, for most return measures, the magnitude of the hedge return is still driven by the long side (the low short interest portfolio), rather than the short side.

5.5 Information in the level of short interest versus the change in short interest

Lastly, we consider whether the positive information in low short interest is the result of changes in short interest rather than levels. For example, the stocks we classify as lightly shorted include at least some issues that have experienced a sharp and unexpected decrease in short interest. To the extent that such a drop is the result of (or is a signal of) some sort of good news, we should observe positive abnormal returns. Of course, even if this explanation has merit, it would not explain the persistence we observe, but it would at least shed some light on the source of the abnormal returns.

We investigate this idea by comparing the short interest in each month for each stock to its average value over the three previous months and, separately, to just the prior month. We define a large decrease in short interest as a drop of 25% or more relative to the three-month average (and, separately, as a minimum 25% drop relative to the prior month).[6] Consistent with other studies, we find that the level of short interest is relatively persistent. For example, on average, 77% of the low SIR stocks migrate by no more than one decile in the subsequent

[6] A problem arises in cases where the short interest drops to zero from a very small value, a 100% decline. Since we do not want to consider changes in short interest large in such cases, we also require a minimum one basis point decrease in the SIR in conjunction with the 25% drop.

month.[7] In the high short interest deciles, this persistence is even more pronounced—96% of the stocks move by no more than one SIR decile.

Because of the persistence in short interest, relatively few stocks in our low SIR experience large declines, and the ones that do are concentrated in the late 1990s. If we exclude stocks with large decreases and increases in short interest relative to the prior three month average (eliminating 7.7% of our sample), our conclusions are unaffected (results using only the previous month's short interest to measure the change in short interest are quantitatively and qualitatively similar). Thus, unexpected decreases in short interest do not seem to be driving our results.[8]

6. Summary and conclusions

We contribute to the ongoing debate regarding the role of short sellers in making prices more informative. Using short interest data on NYSE-, AMEX-, and NASDAQ-listed stocks from 1988 to 2005, we examine stocks that are relatively intensively traded (as measured by share turnover), but nonetheless have little short interest. We find that these stocks are significantly undervalued, both statistically and economically. The positive abnormal returns on these stocks are often larger (in absolute value) than the negative returns on portfolios of heavily shorted stocks. They are robust to issues such as portfolio weighting, the timing of portfolio

---

[7] For low SIR stocks, changes in SIR deciles are often economically insignificant. For example, in our sample, on average, the first decile SIR cutoff is 1.04 bp and the second decile SIR cutoff is 5.1 bp, so migration from one to the other is a very small change in short interest.

[8] We also conduct a more direct test of the relative importance of short interest levels against short interest changes. Using a double-sort procedure, we first sort stocks on the SIR level and then on contemporaneous month-to-month changes in SIR. We find that controlling for the level of SIR in this way, changes have little to no additional explanatory power for next-month returns. In contrast, a double sort first on changes in SIR and then on the level produces almost identical results to a univariate sort on the level. Therefore, our results are unlikely to be caused by unusual changes in short interest.

formation, the risk-adjustment procedure, the inclusion/exclusion of new lists and low-priced stocks, and the 1998-2000 period.

Overall, we show that short sellers appear to be somewhat successful in identifying overvalued stocks to short, but they seem to be at least as adept at identifying (and avoiding) undervalued stocks. The positive abnormal returns earned by lightly shorted stocks are economically large and can be exploited with simple buy-only strategies. The short interest data we use are fully public, and the stocks in question are relatively intensively traded. There are no meaningful barriers to arbitrage, so our results challenge traditional views of market efficiency.

The undervaluation of lightly shorted stocks is concentrated in smaller stocks, but this only makes matters more puzzling. Such stocks are usually viewed as more difficult and/or expensive to short, so a lack of short interest could be indicative of a barrier to short selling. If the absence of short selling in these stocks is due to short sale constraints, then we might expect them to be overvalued (Miller, 1977) or correctly valued only on average (Diamond and Verrecchia, 1987), but no model of which we are aware suggests undervaluation. Additionally, why would the more liquid of these stocks (as measured by turnover) be the most undervalued?

In the same vein, orthodox thinking is that short sale constraints inhibit the incorporation of negative information in stock prices, possibly leading to misvaluation and contributing to market crashes. In this framework, there are no barriers to the incorporation of positive information. This asymmetry is crucial in understanding how short sale constraints can explain important characteristics of market crashes, such as the tendency for stock returns to become highly correlated during meltdowns. Our findings casts doubt on this supposed asymmetry, showing that, for whatever reason, significant positive information is also only slowly reflected in certain types of stocks. And that’s the good news in short interest.

References

Asquith, P., Meulbroek, L., 1995. An empirical investigation of short interest. Working paper, M.I.T.

Asquith, P., Oman, R., Safaya, C., 2008, Short sales and trade classification algorithms, Journal of Financial Markets, forthcoming.

Asquith, P., Pathak, P. A., Ritter, J. R., 2005. Short interest, institutional ownership, and stock returns. Journal of Financial Economics 78, 243-276.

Boehme, R. D., Danielsen, B. R., Sorescu, S. M., 2006. Short sale constraint, differences of opinion, and overvaluation. Journal of Financial and Quantitative Analysis 41, 455-487.

Boehmer, E., Jones, C. M., Zhang, X., 2008. Which shorts are informed? Journal of Finance 63, 491-527.

Boehmer, E. Jones, C. M., Zhang, X., 2009. Unshackling short sellers: The repeal of the uptick rule, Working paper, University of Oregon.

Boehmer, E., Kelley, E., 2009. Institutional investors and the informational efficiency of prices. Review of Financial Studies, forthcoming.

Brent, A., Morse, D., Stice, E. K., 1990. Short interest: explanations and tests. Journal of Financial and Quantitative Analysis 25, 273-289.

Carhart, M., 1997. On persistence in mutual fund performance. Journal of Finance 52, 57-82.

Chen, H., Singal, V., 2003. Role of speculative short sales in price formation: The case of the weekend effect. Journal of Finance 58, 685-705.

Chen, J., Hong, H., Stein, J. C., 2002. Breadth of ownership and stock returns. Journal of Financial Economics 66, 171-205.

Cohen, L., Diether, K. B., Malloy, C., 2007. Supply and demand shifts in the shorting market. Journal of Finance 62, 2061-2096.

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

Desai, H., Ramesh, K., Thiagarajan, S. R., Balachandran, B. V., 2002. Investigation of the information role of short interest in the NASDAQ market. Journal of Finance 57, 2263-2287.

Diamond, D., Verrecchia, R., 1987. Constraints on short selling and asset price adjustment to private information. Journal of Financial Economics 18, 277-311.

Diether, K., Lee, K-H., Werner. I. M., 2008. Short-sale strategies and return predictability? Review of Financial Studies 22 (2), 575-607.

Epstein, G., 1995. Short can be sweet. Barron's Oct. 2.

Fama, E. G., French, K. R., 1993. Common risk factors in returns on stocks and bonds. Journal of Financial Economics 33, 3-56.

Figlewski, S., 1981. The information effects of restrictions on short sales: Some empirical evidence. Journal of Financial and Quantitative Analysis 16, 463-476.

Gallmeyer, M., Hollifield, B., 2008. An examination of heterogeneous beliefs with a short-sale constraint in a dynamic economy. Review of Finance 12, 323-364;

Geczy, C. C., Musto, D. K., Reed, A. V., 2002. Stocks are special too: An analysis of the equity lending market. Journal of Financial Economics 66, 241-269.

Gompers, P. A., Metrick, A., 2001. Institutional investors and equity prices. Quarterly Journal of Economics 116, 229-259.

Haruvy, E., Noussair, C. N., 2006. The effect of short selling on bubbles and crashes in experimental spot asset markets, Journal of Finance 61, 1119-1157.

Hong, H., Stein, J. C., 2003. Differences of opinion, short-sale constraints, and market crashes. Review of Financial Studies 16, 487-525.

Miller, E., 1977. Risk, uncertainty and divergence of option. Journal of Finance 32, 1151-1168.

Rubinstein, M., 2004. Great moments in financial economics: III. Short-sales and stock prices. Journal of Investment Management 2, 16-31.

Senchack, A. J., Jr., Starks, L. T., 1993. Short-sale restrictions and market reaction to short-interest announcements. Journal of Financial and Quantitative Analysis 28, 177-194.

Seneca, J. J., 1967. Short interest: Bearish or bullish. Journal of Finance 22, 67-70.

Sorescu, S. M., 2000. The effect of options on stock prices: 1973-1995, Journal of Finance 55, 487-514.

Shleifer, A., Vishny, R. W., 1997. The limits of arbitrage. Journal of Finance 52, 35–55.

Williams, J. B. (1938). *The Theory of Investment Value* (Cambridge, MA: Harvard University Press, 1938); reprinted (Burlington, VT: Fraser Publishing, 1997).

Table 1

Regression analysis results of monthly returns on lightly and highly shorted stock portfolios

$$R_{port\ t} - Rf_t = a_{port} + b_{port}\ RMRF_t + s_{port}\ SMB_t + h_{port}\ \ HML_t + m_{port}\ \ MOM_t + e_{port\ t}$$

The dependent variable is the equal- or value-weighted monthly portfolio excess return ($R_{port\ t} - Rf_t$) on highly or lightly shorted stock portfolios for the first month subsequent to portfolio creation based on a combined sample of NYSE, AMEX, and NASDAQ stocks. $RMRF_t$ is the realized market risk premium; SMB_t is the excess return of a portfolio of small stocks over a portfolio of big stocks; HML_t is the excess return of a portfolio of high book-to-market-value stocks over a portfolio of low book-to-market-value stocks; and MOM_t is the excess return on the prior-period winners portfolio over the prior-period losers portfolio. The monthly realizations for the three Fama-French factors and for Carhart's momentum factor are from WRDS. The portfolios SIR 99%, SIR 95%, and SIR 90% include stocks with short interest ratios (SIRs) from the 99^{th}, 95^{th}, and 90^{th} percentiles in month $t - 1$, respectively. The portfolios SIR 1%, SIR 5%, and SIR 10% include stocks with SIRs from the 1^{st}, 5^{th}, and 10^{th} percentile in month t - 1. Portfolio raw returns and the excess returns over the risk-free rate are shown under the headings *Raw ret* and *Excess ret*. The average number of stocks in the portfolios is shown under "*# stocks*." Regression coefficients are reported with *p*-values in italics. The sample period is based on monthly short interest data from June 1988 to December 2005.

Panel A: Monthly equal-weighted returns of high and low SIR stock portfolios

Portfolios / # *stocks*	Raw ret.	Excess ret.	Intercept	RMRF	SMB	HML	MOM
SIR 99%	-0.001	-0.005	-0.012	1.359	1.239	-0.202	-0.282
# 45 stocks			*<.001*	*<.001*	*<.001*	*0.041*	*<.001*
SIR 95%	0.004	0.000	-0.005	1.303	1.102	-0.144	-0.387
# 221 stocks			*0.002*	*<.001*	*<.001*	*0.019*	*<.001*
SIR 90%	0.005	0.002	-0.004	1.298	1.001	-0.087	-0.381
# 441 stocks			*0.007*	*<.001*	*<.001*	*0.084*	*<.001*
SIR1%	0.021	0.017	0.014	0.563	0.701	0.383	-0.319
# 232 stocks			*<.001*	*<.001*	*<.001*	*<.001*	*<.001*
SIR 5%	0.020	0.017	0.013	0.592	0.722	0.415	-0.282
# 302 stocks			*<.001*	*<.001*	*<.001*	*<.001*	*<.001*
SIR10%	0.020	0.017	0.013	0.607	0.769	0.412	-0.251
# 473 stocks			*<.001*	*<.001*	*<.001*	*<.001*	*<.001*
SIR1%-SIR99%	0.022		0.026	-0.796	-0.538	0.585	-0.037
			<.001	*<.001*	*<.001*	*<.001*	*0.581*
SIR5%-SIR95%	0.017		0.019	-0.710	-0.380	0.558	0.105
			<.001	*<.001*	*<.001*	*<.001*	*0.026*
SIR10%-SIR90%	0.015		0.016	-0.690	-0.233	0.499	0.130
			<.001	*<.001*	*<.001*	*<.001*	*0.002*

Panel B: Monthly value-weighted returns of high and low SIR stock portfolios

Portfolios / # *stocks*	Raw ret.	Excess ret.	Intercept	RMRF	SMB	HML	MOM
SIR 99%	0.004	0.001	-0.009	1.436	0.985	-0.298	-0.030
# 45 stocks			*0.005*	*<.001*	*<.001*	*0.007*	*0.642*
SIR 95%	0.010	0.006	-0.001	1.358	0.584	-0.380	-0.040
# 221 stocks			*0.452*	*<.001*	*<.001*	*<.001*	*0.276*
SIR 90%	0.011	0.007	0.000	1.332	0.448	-0.319	-0.101
# 441 stocks			*0.937*	*<.001*	*<.001*	*<.001*	*0.001*
SIR1%	0.013	0.009	0.005	0.544	0.521	0.484	-0.128
# 232 stocks			*0.003*	*<.001*	*<.001*	*<.001*	*<.001*
SIR 5%	0.014	0.010	0.005	0.590	0.543	0.514	-0.110
# 302 stocks			*0.001*	*<.001*	*<.001*	*<.001*	*<.001*
SIR10%	0.014	0.010	0.004	0.614	0.566	0.510	-0.090
# 473 stocks			*0.002*	*<.001*	*<.001*	*<.001*	*0.002*
SIR1%-SIR99%	0.009		0.013	-0.892	-0.464	0.782	-0.099
			<.001	*<.001*	*<.001*	*<.001*	*0.149*
SIR5%-SIR95%	0.004		0.006	-0.767	-0.041	0.894	-0.069
			0.013	*<.001*	*0.561*	*<.001*	*0.179*
SIR10%-SIR90%	0.003		0.004	-0.718	0.118	0.830	0.011
			0.049	*<.001*	*0.060*	*<.001*	*0.811*

Table 2

Regression analysis results of monthly returns on lightly and highly shorted NASDAQ stock portfolios

$$R_{port\ t} - Rf_t = a_{port} + b_{port}\ RMRF_t + s_{port}\ SMB_t + h_{port}\ HML_t + m_{port}\ MOM_t + e_{port\ t}$$

The dependent variable is the equal- or value-weighted monthly portfolio excess return ($R_{port\ t} - Rf_t$) on highly or lightly shorted stock portfolios for the first month subsequent to portfolio creation based on NASDAQ stocks. $RMRF_t$ is the realized market risk premium; SMB_t is the excess return of a portfolio of small stocks over a portfolio of big stocks; HML_t is the excess return of a portfolio of high book-to-market-value stocks over a portfolio of low book-to-market-value stocks; and MOM_t is the excess return on the prior-period winners portfolio over the prior-period losers portfolio. The monthly realizations for the three Fama-French factors and for Carhart's momentum factor are from WRDS. The portfolios SIR 99%, SIR 95%, and SIR 90% include stocks with short interest ratios (SIRs) from the 99^{th}, 95^{th}, and 90^{th} percentiles in month $t - 1$, respectively. The portfolios SIR 1%, SIR 5%, and SIR 10% include stocks with SIRs from the 1^{st}, 5^{th}, and 10^{th} percentile in month t - 1. Portfolio raw returns and the excess returns over the risk-free rate are shown under the headings *Raw ret* and *Excess ret*. The average number of stocks in the portfolios is shown under "# *stocks*." Regression coefficients are reported with *p*-values in italics. The sample period is based on monthly short interest data from June 1988 to December 2005.

Panel A: Monthly equal-weighted returns of high and low SIR stock portfolios							
Portfolios / #stocks	Raw ret.	Excess ret.	Intercept	RMRF	SMB	HML	MOM
SIR 99%	0.000	-0.003	-0.010	1.352	1.256	-0.458	-0.263
31 Stock			*0.003*	*<.001*	*<.001*	*<.001*	*<.001*
SIR 95%	0.005	0.002	-0.003	1.296	1.202	-0.545	-0.387
151 Stocks			*0.104*	*<.001*	*<.001*	*<.001*	*<.001*
SIR 90%	0.006	0.002	-0.003	1.292	1.140	-0.509	-0.401
304 Stocks			*0.156*	*<.001*	*<.001*	*<.001*	*<.001*
SIR1%	0.023	0.019	0.017	0.529	0.682	0.306	-0.318
214 Stocks			*<.001*	*<.001*	*<.001*	*0.001*	*<.001*
SIR 5%	0.023	0.019	0.016	0.558	0.711	0.350	-0.305
249 Stocks			*<.001*	*<.001*	*<.001*	*<.001*	*<.001*
SIR10%	0.022	0.018	0.014	0.587	0.734	0.362	-0.264
361 Stocks			*<.001*	*<.001*	*<.001*	*<.001*	*<.001*
SIR1%-SIR99%	0.023		0.027	-0.823	-0.574	0.764	-0.055
			<.001	*<.001*	*<.001*	*<.001*	*0.490*
SIR5%-SIR95%	0.017		0.019	-0.738	-0.492	0.895	0.082
			<.001	*<.001*	*<.001*	*<.001*	*0.100*
SIR10%-SIR90%	0.016		0.017	-0.705	-0.406	0.871	0.138
			<.001	*<.001*	*<.001*	*<.001*	*0.002*

Panel B: Monthly value-weighted returns of high and low SIR stock portfolios							
Portfolios / #stocks	Raw ret.	Excess ret.	Intercept	RMRF	SMB	HML	MOM
SIR 99%	0.007	0.004	-0.007	1.528	1.082	-0.773	0.083
31 Stock			*0.069*	*<.001*	*<.001*	*<.001*	*0.270*
SIR 95%	0.012	0.008	0.002	1.435	0.693	-0.947	-0.081
151 Stocks			*0.526*	*<.001*	*<.001*	*<.001*	*0.122*
SIR 90%	0.012	0.008	0.003	1.388	0.585	-0.963	-0.144
304 Stocks			*0.242*	*<.001*	*<.001*	*<.001*	*0.002*
SIR1%	0.014	0.010	0.006	0.480	0.514	0.404	-0.130
214 Stocks			*0.001*	*<.001*	*<.001*	*<.001*	*<.001*
SIR 5%	0.014	0.011	0.006	0.532	0.543	0.438	-0.138
249 Stocks			*<.001*	*<.001*	*<.001*	*<.001*	*<.001*
SIR10%	0.015	0.011	0.006	0.569	0.575	0.456	-0.102
361 Stocks			*<.001*	*<.001*	*<.001*	*<.001*	*0.001*
SIR1%-SIR99%	0.007		0.013	-1.048	-0.569	1.178	-0.213
			0.002	*<.001*	*<.001*	*<.001*	*0.011*
SIR5%-SIR95%	0.002		0.004	-0.903	-0.150	1.385	-0.057
			0.165	*<.001*	*0.091*	*<.001*	*0.373*
SIR10%-SIR90%	0.003		0.003	-0.820	-0.010	1.419	0.043
			0.270	*<.001*	*0.903*	*<.001*	*0.465*

Table 3

Regression analysis results of monthly returns on lightly and highly shorted NYSE-AMEX stock portfolios

$$R_{port\ t} - Rf_t = a_{port} + b_{port}\ RMRF_t + s_{port}\ SMB_t + h_{port}\ HML_t + m_{port}\ MOM_t + e_{port\ t}$$

The dependent variable is the equal- or value-weighted monthly portfolio excess return ($R_{port\ t} - Rf_t$) on highly or lightly shorted stock portfolios for the first month subsequent to portfolio creation based on NYSE-AMEX stocks. $RMRF_t$ is the realized market risk premium; SMB_t is the excess return of a portfolio of small stocks over a portfolio of big stocks; HML_t is the excess return of a portfolio of high book-to-market-value stocks over a portfolio of low book-to-market-value stocks; and MOM_t is the excess return on the prior-period winners portfolio over the prior-period losers portfolio. The monthly realizations for the three Fama-French factors and for Carhart's momentum factor are from WRDS. The portfolios SIR 99%, SIR 95%, and SIR 90% include stocks with short interest ratios (SIRs) from the 99^{th}, 95^{th}, and 90^{th} percentiles in month $t - 1$, respectively. The portfolios SIR 1%, SIR 5%, and SIR 10% include stocks with SIRs from the 1^{st}, 5^{th}, and 10^{th} percentile in month t - 1. Portfolio raw returns and the excess returns over the risk-free rate are shown under the headings *Raw ret* and *Excess ret*. The average number of stocks in the portfolios is shown under "# *stocks*." Regression coefficients are reported with *p*-values in italics. The sample period is based on monthly short interest data from June 1988 to December 2005.

Portfolios / #stocks	Raw ret.	Excess ret.	Intercept	RMRF	SMB	HML	MOM
SIR 99%	-0.007	-0.010	-0.018	1.375	1.024	0.482	-0.426
15 Stock			*<.001*	*<.001*	*<.001*	*0.001*	*<.001*
SIR 95%	0.002	-0.001	-0.010	1.346	0.866	0.698	-0.396
71 Stocks			*<.001*	*<.001*	*<.001*	*<.001*	*<.001*
SIR 90%	0.005	0.001	-0.007	1.319	0.731	0.702	-0.316
141 Stocks			*<.001*	*<.001*	*<.001*	*<.001*	*<.001*
SIR1%	0.014	0.010	0.003	0.716	0.887	0.886	-0.195
22 Stocks			*0.400*	*<.001*	*<.001*	*<.001*	*0.021*
SIR 5%	0.014	0.011	0.004	0.772	0.730	0.648	-0.185
71 Stocks			*0.039*	*<.001*	*<.001*	*<.001*	*<.001*
SIR10%	0.014	0.011	0.004	0.808	0.683	0.650	-0.163
141 Stocks			*0.013*	*<.001*	*<.001*	*<.001*	*<.001*
SIR1%-SIR99%	0.021		0.021	-0.659	-0.137	0.404	0.231
			<.001	*<.001*	*0.380*	*0.038*	*0.042*
SIR5%-SIR95%	0.012		0.014	-0.574	-0.136	-0.051	0.211
			<.001	*<.001*	*0.070*	*0.590*	*<.001*
SIR10%-SIR90%	0.009		0.011	-0.511	-0.048	-0.052	0.154
			<.001	*<.001*	*0.378*	*0.441*	*<.001*

Panel B: Monthly value-weighted returns of high and low SIR stock portfolios

Portfolios / #stocks	Raw ret.	Excess ret.	Intercept	RMRF	SMB	HML	MOM
SIR 99%	0.002	-0.002	-0.011	1.400	0.685	0.504	-0.292
15 Stock			*0.023*	*<.001*	*<.001*	*0.003*	*0.003*
SIR 95%	0.008	0.004	-0.005	1.397	0.451	0.473	-0.185
71 Stocks			*0.024*	*<.001*	*<.001*	*<.001*	*<.001*
SIR 90%	0.011	0.007	-0.002	1.297	0.233	0.433	-0.121
141 Stocks			*0.290*	*<.001*	*<.001*	*<.001*	*0.001*
SIR1%	0.014	0.011	0.003	0.719	0.546	0.693	-0.034
22 Stocks			*0.261*	*<.001*	*<.001*	*<.001*	*0.580*
SIR 5%	0.012	0.008	0.002	0.873	0.398	0.497	-0.151
71 Stocks			*0.416*	*<.001*	*<.001*	*<.001*	*<.001*
SIR10%	0.012	0.008	0.003	0.839	0.255	0.238	-0.189
141 Stocks			*0.112*	*<.001*	*<.001*	*0.001*	*<.001*
SIR1%-SIR99%	0.013		0.014	-0.682	-0.138	0.189	0.259
			0.013	*<.001*	*0.392*	*0.350*	*0.029*
SIR5%-SIR95%	0.004		0.007	-0.523	-0.053	0.024	0.034
			0.024	*<.001*	*0.529*	*0.820*	*0.576*
SIR10%-SIR90%	0.001		0.005	-0.457	0.022	-0.195	-0.067
			0.073	*<.001*	*0.781*	*0.054*	*0.251*

Table 4

Comparison of firm characteristics for high and low short interest ratio (SIR) stocks for 1988 to 2005

High SIR and low SIR stocks each month have SIRs from the top and bottom deciles in the combined sample of NYSE, AMEX, and NASDAQ stocks. *Market capitalization* (in millions) is calculated monthly as shares outstanding times the month-end share price. *Total sales* is annual total sales (in millions). *Book-to-market* (*equity*) is the book value of equity per share relative to the month-end share price. *Book-to-market* (*asset*) is the sum of the book value of equity and book value of debt (including short term and long term debt) relative to the sum of the market value of equity and the book value of debt. *Debt-equity ratio* is the total debt (the sum of the short term and long term debt) relative to the book value of equity. *Earnings-price ratio* is EPS relative to the end-of-fiscal-year share price. *Profit margin* is annual net income relative to sales. *Turnover* is the monthly number of shares traded relative to the number of shares outstanding and *SIR* (short interest ratio) is monthly short interest relative to the number of shares outstanding. Share prices and shares outstanding are from CRSP. All other data (except *SIR*) are from Compustat. The reported values of zero for *SIR* are due to rounding. Means and medians tests are based on the time-series of monthly cross-sectional means and medians, respectively.

	Low SIR stocks		High SIR stocks		Means *t*-test	Medians *s*-test
	Mean	Median	Mean	Median	*p*-value	*p*-value
Market capitalization	58.312	28.848	1,125.094	410.403	*<.001*	*<.001*
Total sales	93.857	37.235	1,233.294	299.407	*<.001*	*<.001*
Book-to-market (equity)	0.998	0.831	0.612	0.427	*<.001*	*<.001*
Book-to-market (asset)	0.932	0.868	0.569	0.507	*<.001*	*<.001*
Debt-equity ratio	1.563	0.416	2.462	0.545	*<.001*	*<.001*
Earnings-price ratio	-0.149	0.038	-0.170	0.026	0.154	*<.001*
Profit margin	-0.724	0.026	-5.547	0.029	*<.001*	0.051
Turnover	0.035	0.019	0.274	0.182	*<.001*	*<.001*
SIR	0.000	0.000	0.089	0.071	N/A	N/A
Share price	8.619	5.303	22.594	18.357	*<.001*	*<.001*

Table 5

Regression analysis results of monthly returns on 64 triple-sorted (based on size, share turnover, and short interest ratio) portfolios

$$R_{port\,t} - Rf_t = \alpha_{port} + b_{port}\, RMRF_t + s_{port}\, SMB_t + h_{port}\, HML_t + m_{port}\, MOM_t + e_{port\,t}$$

The dependent variable is the monthly value-weighted excess return on one of 64 triple-sorted portfolios for the first month subsequent to portfolio creation. We first form size quartiles based on market capitalization. In Panel A, size sorts are based on the full sample. In Panels B and C, size sorts are based on NYSE-AMEX and NASDAQ stocks only, respectively. Within each size quartile, we form share turnover quartiles. Lastly, within each share turnover quartile, we create short interest ratio (SIR) quartile portfolios. $RMRF_t$ is the realized market risk premium; SMB_t is the excess return of a portfolio of small stocks over a portfolio of big stocks; HML_t is the excess return of a portfolio of high book-to-market-value stocks over a portfolio of low book-to-market-value stocks; and MOM_t is the excess return on the prior-period winners portfolio over the prior-period losers portfolio. For Panels A and B, the monthly returns on the three Fama-French factors and Carhart's momentum factor are from WRDS. In Panel C, we follow the Fama-French and Carhart procedures and compute the corresponding factor returns using only NASDAQ-listed stocks. The monthly short interest portfolios are created for June 1988 to December 2005. Only the intercepts and the relevant *p*-values (in italics) are shown.

Panel A. Fama-French-Carhart alphas (monthly abnormal returns) for triple sorted portfolios (based on full sample of NYSE, AMEX, and NASDAQ stocks)

	Low turnover (quartile=1)	Med-low turnover (quartile=2)	Med-high turnover (quartile=3)	High turnover (quartile=4)
Small size (quartile=1)				
Low SIR	0.003	0.010	0.017	0.018
(quartile=1)	*0.190*	*0.001*	*<.001*	*<.001*
Med-low SIR	0.002	0.005	0.011	0.020
(quartile=2)	*0.465*	*0.070*	*0.006*	*<.001*
Med-high SIR	0.004	0.008	0.014	0.016
(quartile=3)	*0.104*	*0.012*	*<.001*	*0.003*
High SIR	0.000	0.002	0.004	0.003
(quartile =4)	*0.906*	*0.594*	*0.324*	*0.574*
Low SIR-	0.003	0.008	0.012	0.015
High SIR	*0.355*	*0.004*	*<.001*	*0.001*
Med-small size (quartile=2)				
Low SIR	0.002	0.005	0.009	0.016
(quartile=1)	*0.195*	*0.013*	*<.001*	*<.001*
Med-low SIR	0.002	0.000	0.006	0.015
(quartile=2)	*0.357*	*0.961*	*0.031*	*<.001*
Med-high SIR	-0.001	-0.003	0.001	0.006
(quartile=3)	*0.489*	*0.066*	*0.806*	*0.065*
High SIR	-0.006	-0.007	-0.006	-0.001
(quartile =4)	*0.002*	*0.002*	*0.025*	*0.804*
Low SIR-	0.008	0.012	0.015	0.016
High SIR	*<.001*	*<.001*	*<.001*	*<.001*
Med-large size (quartile=3)				
Low SIR	0.002	0.004	0.005	0.012
(quartile=1)	*0.104*	*0.002*	*<.001*	*<.001*
Med-low SIR	0.000	0.001	0.002	0.003
(quartile=2)	*0.841*	*0.576*	*0.190*	*0.195*
Med-high SIR	-0.002	0.000	-0.001	0.000
(quartile=3)	*0.084*	*0.782*	*0.579*	*0.903*
High SIR	-0.005	-0.005	-0.007	-0.007
(quartile =4)	*<.001*	*0.001*	*<.001*	*0.004*
Low SIR-	0.007	0.009	0.012	0.019
High SIR	*<.001*	*<.001*	*<.001*	*<.001*
Large size (quartile=4)				
Low SIR	-0.001	0.001	0.002	0.005
(quartile=1)	*0.489*	*0.317*	*0.388*	*0.052*
Med-low SIR	0.000	0.000	0.001	0.000
(quartile=2)	*0.808*	*0.786*	*0.416*	*0.881*
Med-high SIR	0.000	0.002	-0.001	0.004
(quartile=3)	*0.782*	*0.182*	*0.490*	*0.182*
High SIR	-0.002	-0.002	-0.004	0.000
(quartile =4)	*0.246*	*0.191*	*0.014*	*0.957*
Low SIR-	0.001	0.003	0.005	0.005
High SIR	*0.732*	*0.102*	*0.038*	*0.079*

Panel B. Fama-French-Carhart alphas (monthly abnormal returns) for triple sorted portfolios (NYSE-AMEX stocks only).

	Low turnover (quartile=1)	Med-low turnover (quartile=2)	Med-high turnover (quartile=3)	High turnover (quartile=4)
Small size (quartile=1)				
Low SIR	0.000	0.003	0.008	0.013
(quartile=1)	*0.878*	*0.189*	*0.001*	*<.001*
Med-low SIR	-0.002	0.000	0.003	0.005
(quartile=2)	*0.324*	*0.830*	*0.177*	*0.142*
Med-high SIR	-0.005	-0.003	-0.001	0.003
(quartile=3)	*0.010*	*0.249*	*0.745*	*0.377*
High SIR	-0.007	-0.008	-0.003	-0.013
(quartile =4)	*0.016*	*0.002*	*0.351*	*0.001*
Low SIR-	0.008	0.011	0.011	0.026
High SIR	*0.028*	*<.001*	*0.002*	*<.001*
Med-small size (quartile=2)				
Low SIR	0.003	0.002	0.003	0.006
(quartile=1)	*0.089*	*0.244*	*0.114*	*0.024*
Med-low SIR	-0.002	0.002	0.002	0.000
(quartile=2)	*0.261*	*0.230*	*0.342*	*0.905*
Med-high SIR	-0.001	0.002	0.001	-0.003
(quartile=3)	*0.448*	*0.426*	*0.726*	*0.261*
High SIR	-0.003	-0.003	-0.006	-0.007
(quartile =4)	*0.096*	*0.162*	*0.008*	*0.029*
Low SIR-	0.006	0.005	0.009	0.012
High SIR	*0.003*	*0.027*	*0.001*	*<.001*
Med-large size (quartile=3)				
Low SIR	0.001	0.001	0.003	0.004
(quartile=1)	*0.307*	*0.497*	*0.158*	*0.109*
Med-low SIR	-0.003	0.001	0.000	0.000
(quartile=2)	*0.074*	*0.552*	*0.990*	*0.945*
Med-high SIR	-0.001	-0.002	-0.001	0.001
(quartile=3)	*0.536*	*0.283*	*0.502*	*0.705*
High SIR	-0.002	-0.004	-0.006	-0.004
(quartile =4)	*0.209*	*0.046*	*0.008*	*0.093*
Low SIR-	0.004	0.005	0.009	0.008
High SIR	*0.070*	*0.015*	*<.001*	*0.007*
Large size (quartile=4)				
Low SIR	0.000	0.003	0.003	0.003
(quartile=1)	*0.795*	*0.040*	*0.074*	*0.201*
Med-low SIR	0.001	0.000	0.001	-0.002
(quartile=2)	*0.413*	*0.992*	*0.474*	*0.347*
Med-high SIR	0.001	0.000	0.000	-0.003
(quartile=3)	*0.630*	*0.843*	*0.778*	*0.198*
High SIR	-0.004	-0.001	-0.001	-0.002
(quartile =4)	*0.039*	*0.552*	*0.458*	*0.519*
Low SIR-	0.003	0.005	0.004	0.004
High SIR	*0.134*	*0.070*	*0.083*	*0.175*

Panel C. Fama-French-Carhart alphas (monthly abnormal returns) for triple sorted portfolios (NASDAQ stocks only using NASDAQ-only factor returns and size breakpoints).

	Low turnover (quartile=1)	Med-low turnover (quartile=2)	Med-high turnover (quartile=3)	High turnover (quartile=4)
Small size (quartile=1)				
Low SIR	0.010	0.016	0.020	0.019
(quartile=1)	*<.001*	*<.001*	*<.001*	*<.001*
Med-low SIR	0.007	0.013	0.019	0.027
(quartile=2)	*0.028*	*<.001*	*<.001*	*<.001*
Med-high SIR	0.010	0.009	0.017	0.020
(quartile=3)	*0.002*	*0.003*	*<.001*	*<.001*
High SIR	0.006	0.013	0.015	0.017
(quartile =4)	*0.129*	*<.001*	*<.001*	*0.003*
Low SIR-	0.004	0.003	0.005	0.002
High SIR	*0.369*	*0.327*	*0.211*	*0.784*
Med-small size (quartile=2)				
Low SIR	0.003	0.010	0.012	0.013
(quartile=1)	*0.100*	*<.001*	*<.001*	*<.001*
Med-low SIR	0.003	0.004	0.010	0.013
(quartile=2)	*0.128*	*0.071*	*<.001*	*<.001*
Med-high SIR	0.001	0.002	0.007	0.017
(quartile=3)	*0.586*	*0.300*	*0.007*	*<.001*
High SIR	-0.003	-0.004	0.003	-0.003
(quartile =4)	*0.195*	*0.156*	*0.249*	*0.449*
Low SIR-	0.006	0.013	0.009	0.016
High SIR	*0.007*	*<.001*	*0.007*	*<.001*
Med-large size (quartile=3)				
Low SIR	0.006	0.004	0.010	0.011
(quartile=1)	*0.003*	*0.054*	*<.001*	*0.005*
Med-low SIR	0.002	0.001	0.003	0.008
(quartile=2)	*0.269*	*0.595*	*0.224*	*0.015*
Med-high SIR	0.002	-0.003	0.001	0.001
(quartile=3)	*0.318*	*0.212*	*0.847*	*0.716*
High SIR	-0.004	-0.008	-0.005	-0.003
(quartile =4)	*0.050*	*0.002*	*0.097*	*0.366*
Low SIR -	0.010	0.012	0.015	0.014
High SIR	*<.001*	*<.001*	*<.001*	*0.001*
Large size (quartile=4)				
Low SIR	0.003	0.002	0.004	-0.003
(quartile=1)	*0.120*	*0.582*	*0.149*	*0.445*
Med-low SIR	0.003	0.003	0.005	0.002
(quartile=2)	*0.119*	*0.235*	*0.101*	*0.519*
Med-high SIR	-0.003	0.002	0.000	0.005
(quartile=3)	*0.267*	*0.502*	*0.891*	*0.112*
High SIR	0.002	-0.001	-0.002	-0.003
(quartile =4)	*0.373*	*0.723*	*0.499*	*0.299*
Low SIR -	0.001	0.003	0.006	0.000
High SIR	*0.674*	*0.491*	*0.123*	*0.920*

Table 6

Subsample regression analysis results for monthly returns on 64 triple-sorted (based on size, share turnover, and short interest ratio) portfolios excluding stocks with price less than $5 and the NASDAQ "bubble" period (1998-2000).

$$R_{port\ t} - Rf_t = \alpha_{port} + b_{port}\, RMRF_t + s_{port}\, SMB_t + h_{port}\, HML_t + m_{port}\, MOM_t + e_{port\ t}$$

The dependent variable is the monthly value-weighted excess return on one of 64 triple-sorted portfolios for the first month subsequent to portfolio creation. Based on a combined sample of NYSE, AMEX, and NASDAQ stocks, size quartiles are established based on market capitalization. Within each size quartile, share turnover quartiles are established. Last, within each share turnover quartile, short interest ratio (SIR) quartile portfolios are created. $RMRF_t$ is the realized market risk premium; SMB_t is the excess return of a portfolio of small stocks over a portfolio of big stocks; HML_t is the excess return of a portfolio of high book-to-market-value stocks over a portfolio of low book-to-market-value stocks; and MOM_t is the excess return on the prior-period winners portfolio over the prior-period losers portfolio. The monthly realizations for the three Fama-French factors and for Carhart's momentum factor are from WRDS. The monthly short interest portfolios are created for June 1988 to December 2005. Only the intercepts and the relevant *p*-values (in italics) are shown.

	Low turnover (quartile=1)	Med-low turnover (quartile=2)	Med-high turnover (quartile=3)	High turnover (quartile=4)
Small size (quartile=1)				
Low SIR	0.004	0.006	0.007	0.012
(quartile=1)	*0.049*	*0.001*	*0.001*	*<.001*
Med-low SIR	0.005	0.004	0.006	0.008
(quartile=2)	*0.002*	*0.015*	*0.004*	*0.001*
Med-high SIR	0.004	0.003	-0.002	0.001
(quartile=3)	*0.019*	*0.182*	*0.382*	*0.667*
High SIR	0.002	-0.007	-0.006	-0.010
(quartile =4)	*0.348*	*0.002*	*0.010*	*0.001*
Low SIR-	0.002	0.013	0.013	0.023
High SIR	*0.290*	*<.001*	*<.001*	*<.001*
Med-small size (quartile=2)				
Low SIR	0.004	0.005	0.006	0.007
(quartile=1)	*0.023*	*0.001*	*0.001*	*0.004*
Med-low SIR	0.002	0.003	0.002	0.003
(quartile=2)	*0.303*	*0.011*	*0.280*	*0.144*
Med-high SIR	0.001	-0.005	-0.005	-0.001
(quartile=3)	*0.718*	*0.007*	*0.008*	*0.593*
High SIR	-0.005	-0.008	-0.009	-0.011
(quartile =4)	*0.002*	*<.001*	*<.001*	*<.001*
Low SIR-	0.009	0.013	0.016	0.018
High SIR	*<.001*	*<.001*	*<.001*	*<.001*
Med-large size (quartile=3)				
Low SIR	0.003	0.004	0.005	0.004
(quartile=1)	*0.039*	*0.004*	*0.001*	*0.076*
Med-low SIR	-0.001	0.002	0.001	0.000
(quartile=2)	*0.513*	*0.202*	*0.614*	*0.955*
Med-high SIR	-0.001	0.001	-0.004	-0.003
(quartile=3)	*0.533*	*0.457*	*0.021*	*0.127*
High SIR	-0.001	-0.004	-0.006	-0.006
(quartile =4)	*0.505*	*0.009*	*<.001*	*0.017*
Low SIR-	0.004	0.008	0.011	0.010
High SIR	*0.026*	*<.001*	*<.001*	*0.002*
Large size (quartile=4)				
Low SIR	-0.001	0.002	0.002	0.004
(quartile=1)	*0.455*	*0.103*	*0.198*	*0.107*
Med-low SIR	-0.001	-0.001	-0.002	0.000
(quartile=2)	*0.697*	*0.457*	*0.278*	*0.936*
Med-high SIR	0.002	0.000	0.000	0.000
(quartile=3)	*0.206*	*0.860*	*0.906*	*0.853*
High SIR	-0.001	-0.002	-0.001	-0.001
(quartile =4)	*0.305*	*0.254*	*0.322*	*0.788*
Low SIR-	0.000	0.004	0.004	0.005
High SIR	*0.828*	*0.061*	*0.098*	*0.108*

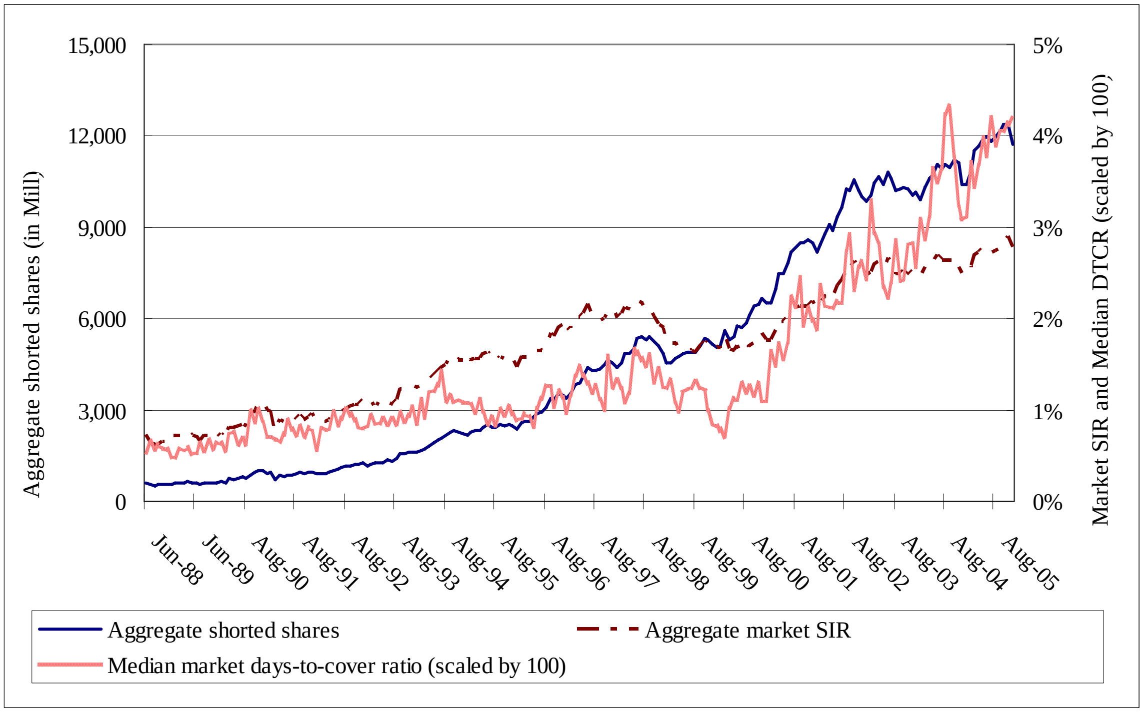


Fig. 1

Time series market aggregate shorted shares and short interest ratio (SIR) and median days-to-cover ratio (DTCR, scaled by 100) from June 1988 to December 2005 based on all NYSE, AMEX, and NASDAQ stocks. The aggregate market SIR is the percentage of all outstanding shares sold short. The market DTCR is the aggregate shorted shares divided by average daily trading volume.

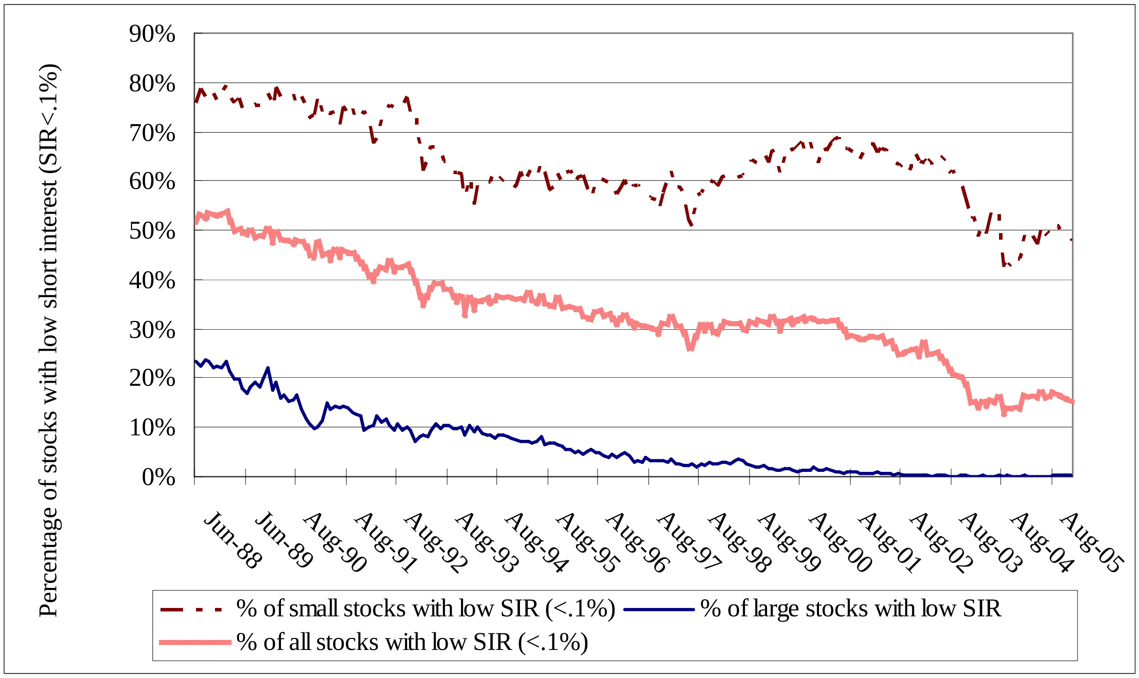
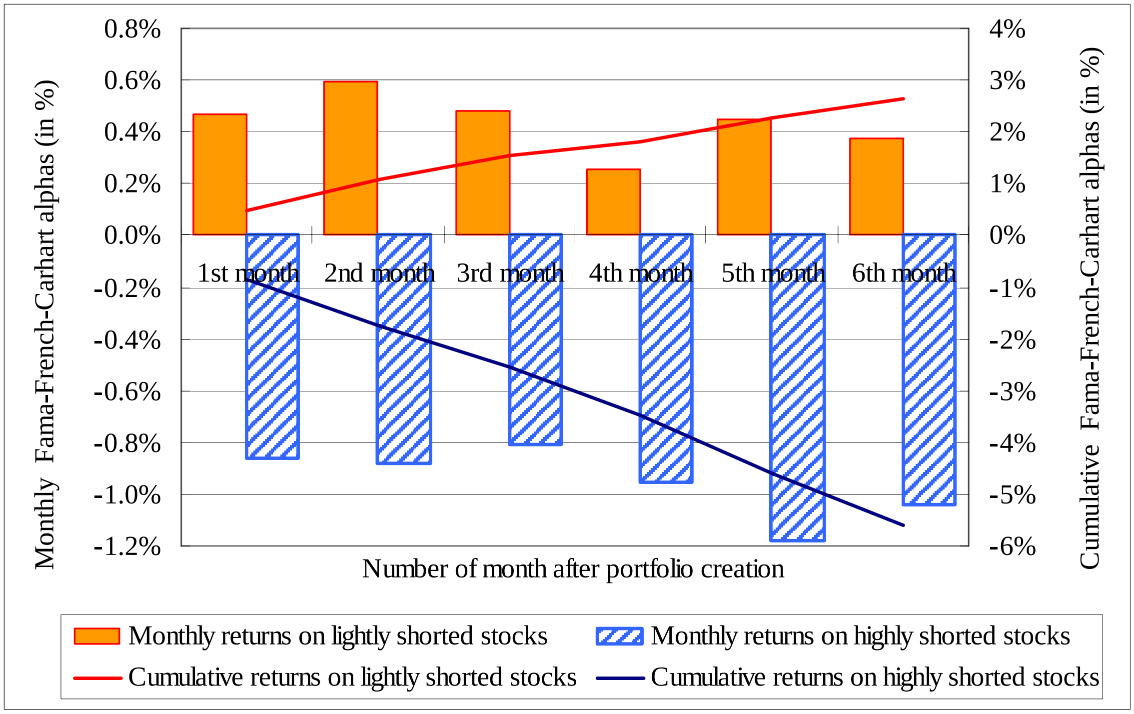


Fig. 2

Time series of the percentage of listed stocks with short interest below 0.1% of shares outstanding from June 1988 to December 2005 for all stocks, for small stocks (from the lowest size quartile), and for large stocks (from the top size quartile) based on NYSE, AMEX, and NASDAQ stocks. Short interest is the percentage of a firm's outstanding shares that have been sold short.

Panel A: Monthly Fama-French-Carhart alphas (abnormal returns) on bottom and top 1% SIR portfolios



Panel B: Monthly Fama-French-Carhart alphas (abnormal returns) on bottom and top decile SIR portfolios

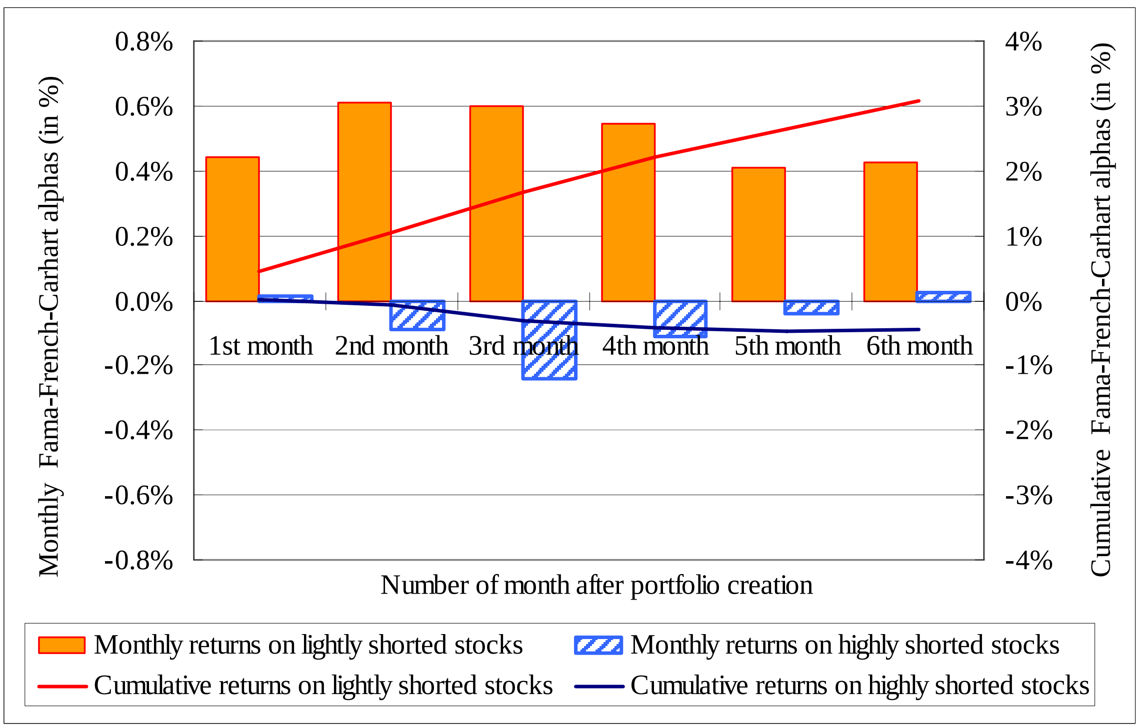
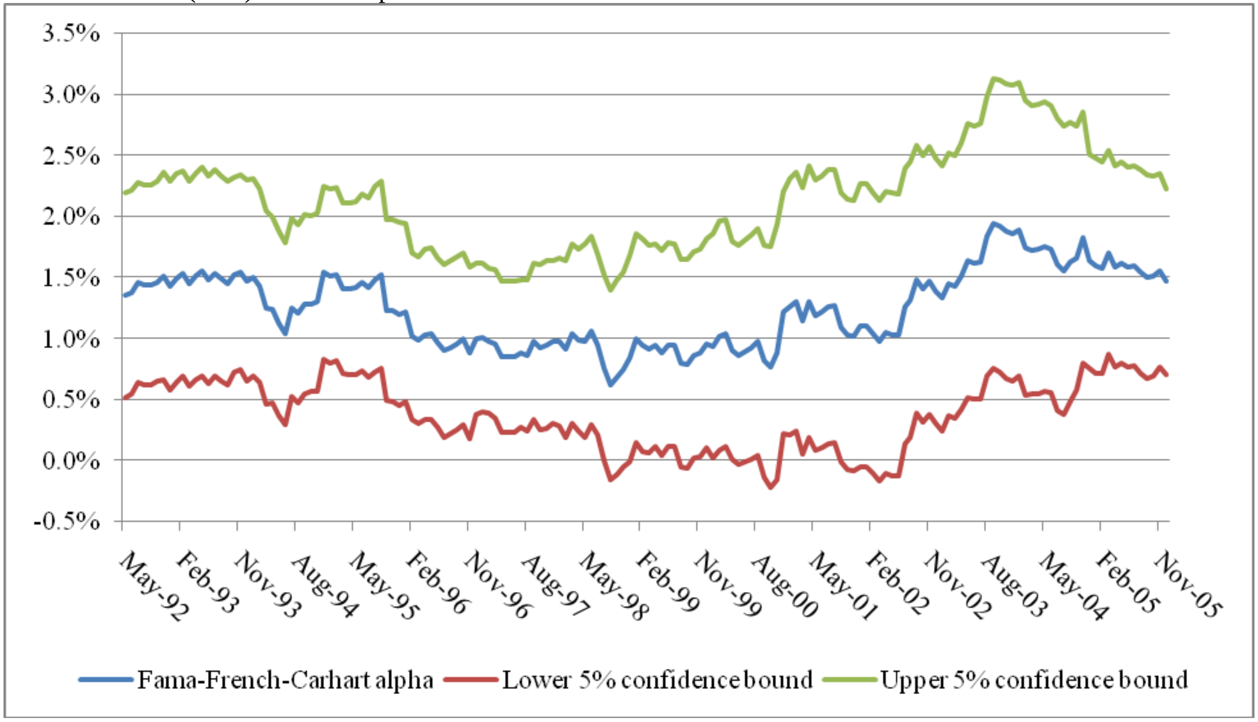


Fig. 3

Monthly Fama-French-Carhart alphas (abnormal returns) on value-weighted high and low SIR stock portfolios for NYSE, AMEX, and NASDAQ stocks for June 1988 to December 2005. Results are shown for the first six months after portfolio formation.

Panel A: Lowest (10%) SIR decile portfolio



Panel B: Highest (90%) SIR decile portfolio

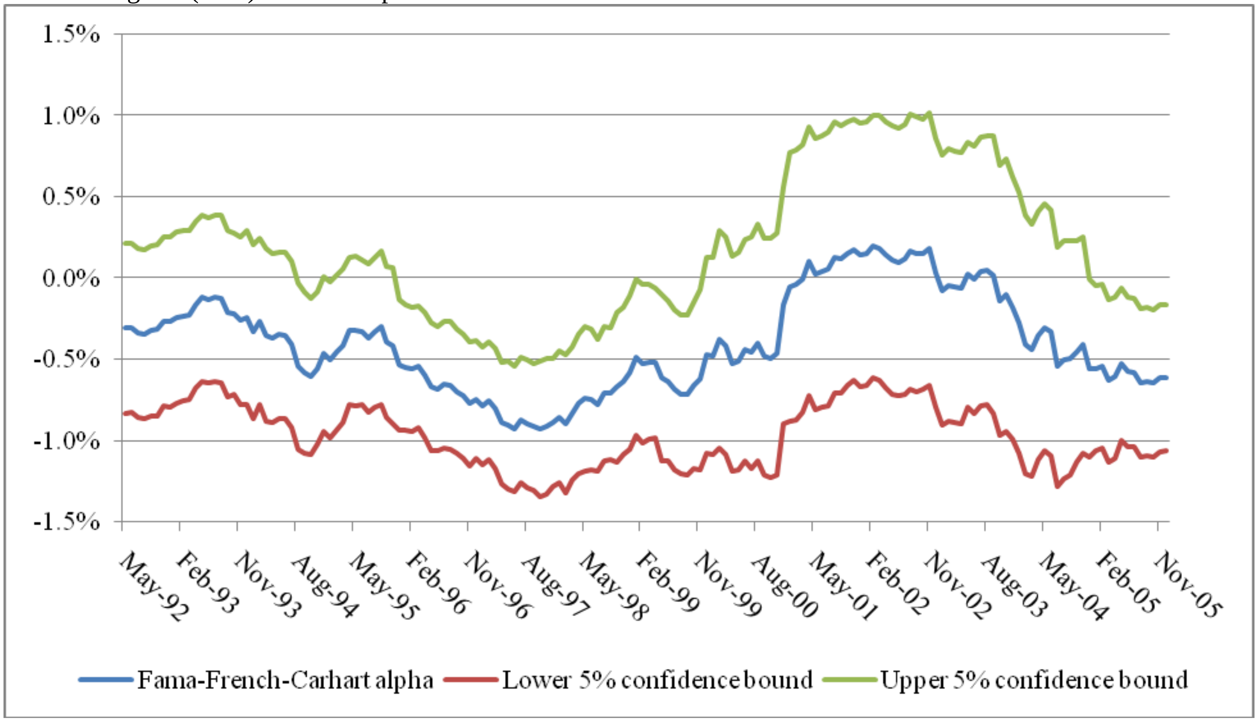


Fig. 4

Fama-French-Carhart alphas (monthly abnormal returns) for portfolios formed on short-interest deciles. Estimation is based on rolling 48-month intervals from June 1988 to December 2005. The graph shows the intercept and the associated 95% confidence interval based on eq. (1) in the text.