

A First Glimpse into the Short Side of Hedge Funds[☆]

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Abstract

We provide direct evidence about the profitability of hedge fund short trades in equities. We identify the opening and closing of equity short sales (and long side trades) by hedge funds and other institutional investors by combining data on the detailed transactions and holdings of the investors. Hedge fund short sales covered within five trading days are highly profitable, earning an average abnormal return of 14 bps per day, but short positions kept open longer than five days are not profitable. In contrast, non-hedge fund institutional investors suffer losses on short sales that are covered within five trading days but earn average abnormal returns of 2.6 bps per day on short trades covered between 21 and 63 days after being opened. Additional evidence suggests that some of the profitability of short trades is due to information and some stems from liquidity provision, and that short selling profitability is persistent.

JEL Classification: G12, G14, G23

Keywords: Hedge funds, short sale profitability, short sales, institutional investors

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1. Introduction

Short interest and other proxies for short-selling activity predict stock returns.¹ However, there is little evidence about the identities of most short sellers and the profitability of their short trades. For example, while it is reasonable to think that a large fraction of short-selling is done by institutional investors, particularly hedge funds, little is known about the short-selling of these investors.² Existing research on the trading of equity hedge funds comes primarily from “snapshots” of long positions disclosed in their quarterly Form 13F filings. For example, Brunnermeier and Nagel (2004), Griffin and Xu (2009), and Agarwal et al (2013) use Form 13F data to examine the long side holdings of hedge funds, but are not able to study the funds’ short positions because the 13F forms do not report them. The lack of evidence regarding hedge fund and other institutional short selling, combined with its likely importance in the price discovery process, motivates its study. The limited evidence of positive abnormal returns to hedge fund long equity positions in Griffin and Xu (2009) and to the positions disclosed in the funds’ original 13F filings in Agarwal et al (2013) also raises the question of whether equity hedge funds are able to generate positive abnormal performance on their short trades.³

This paper provides direct evidence regarding the profitability of hedge fund short trades in equities. As explained below, we identify the opening and covering of equity short sales (and also long side trades) by hedge funds and other institutional investors at the level of individual investment management companies by using a novel algorithm to combine data from two different datasets on the detailed transactions and holdings of institutional investors. Based on

¹ See, for example, Asquith and Meulbroek (1996), Desai et al (2002), Asquith, Pathak, and Ritter (2005), Boehmer, Jones, and Zhang (2008), Diether, Lee, and Werner (2009), Kelley and Tetlock (2014), Boehmer, Huszhár, and Jordan (2015), and Engleberg, Reed, and Ringgenberg (2015), among others.

² An exception to this statement is Jank and Smajbegovic (2015), who use a limited sample of large short sales in European stocks between November 2012 and December 2014 to study the performance of short sellers. Chen, Desai, and Krishnamurthy (2013) study the performance of the stocks sold short by mutual funds, but are unable to determine the profitability of the short sales because they do not observe when the short positions are closed or the prices at which they are closed. As in Hong et al (2015), the ability of measures of shorting activity to predict stock returns does not imply that shorting is profitable because short sellers might incur significant price impact costs in unwinding their trades, especially if the trades are crowded.

³ Agarwal et al (2013) focus on the difference in the performance of the long equity positions disclosed in hedge funds’ amended and original 13F filings, and find that the hedge funds that are not disclosed in the original filings exhibit superior performance. Using Daniel et al (1997) characteristic-adjusted returns they find only weak evidence of superior performance on the positions disclosed in the funds’ original 13F filings. Because the “confidential” positions that are not disclosed in the original 13F filings are small relative to the overall aggregate hedge fund positions, the weak evidence of superior performance on the disclosed positions also applies to the overall aggregate hedge fund position.

our identification of trades, we examine the profitability of hedge fund short trades, including whether hedge funds have skills in both short opening and covering short positions. Hedge fund short sales covered within five trading days are highly profitable, earning an average abnormal return of 14 basis points per day, which translates to about 35% per year. For short sales kept open longer than five days the estimates of average abnormal returns are not significantly different from zero and the point estimates are close to zero. In contrast, non-hedge fund institutional investors suffer losses on short sales that are covered within five trading days but earn average abnormal returns of 2.6 basis points per day (approximately 6.6% per year) on short trades covered between 21 and 63 days after they are opened.

We also present evidence about some of the sources of the abnormal returns. Hedge fund short positions opened in a short window prior to earnings announcements predict negative earnings surprises, and their short trades that are open during the earnings announcement and covered within five trade dates of being opened are profitable, consistent with a role for private information. In contrast, short selling by non-hedge fund investors does not show any correlation with firms' earnings surprises. Some of the hedge fund short sale profitability appears to consist of profits from liquidity provision, as short positions opened on trading dates with positive abnormal stock returns and closed with five trading dates are profitable on average while those opened on trading days with negative abnormal returns are not profitable. Hedge fund short-selling abnormal performance is persistent, consistent with it being due to skill, but that of non-hedge funds is not. In addition, we present corresponding results about the profitability of the hedge fund and non-hedge fund investor long side trades. Our result contrast with existing studies that are unable to identify short sales at the manager level but rather examine whether short sales (by unidentified investors) reflected in short interest and other proxies for shorting activity predict future stock returns.

The transaction data we use are from ANcerno, a trade execution cost consulting firm, and include on a daily basis all transactions by a set of institutional investors. Anand, Irvine, Puckett, and Ventakaraman (2012), Puckett and Yan (2011), and Jame (2015) have used ANcerno data to study institutional investors' trading ability. The version of the dataset we use includes the names of fund management companies and both their long and short transactions, including the transaction prices. We combine these data with institutional holdings obtained from 13F forms, which report only long positions. The idea of our algorithm is to combine quarterly

snapshot of long positions from the 13F data with the ANcerno data on all trades to determine the long or short position of each investment manager at the time of each trade, enabling us to identify the trades that open short positions. We also identify three other types of trades, these being purchases that cover short positions (short buys), purchases that establish long positions (long buys), and sales that close long positions (long sells). After identifying their trades we categorize investment management firms into hedge funds and non-hedge fund investors using information in the investment managers' Form ADV filings.

Through this algorithm, we identify short sales (short sells), short buys, long buys, and long sells for 53 hedge fund management companies and 141 non-hedge fund management companies from January 1999 through September 2011. The data include a total of 2,967,918 daily hedge fund net trades, of which 213,337 are trades that either open or close short positions. To check whether the algorithm correctly identifies short sales, we examine the identified short sales during September and October of 2008 when short sales of the stocks of a set of financial firms were banned by the SEC. There is a dramatic decrease in hedge funds short sales of financial company stocks on the date of the ban and an even more dramatic increase on the termination of the ban, verifying that our algorithm successfully identifies short sales. Similar changes in short sales around the period of the short sale ban are reported in Boehmer, Jones, and Zhang (2013).

Having identified the short sales and other trades, we first provide evidence about the profitability of short sales by hedge funds in comparison to the other non-hedge fund institutional investors. To this end, we exploit the unique feature of our data and examine the profitability of the closed hedge fund short sales. We find that hedge fund short sales in our sample are profitable, especially for short horizons. Specifically, hedge fund short trades that are covered within five trading days on average earn an abnormal return based on characteristic-matched portfolios (Daniel, Grinblatt, Titman, and Wermers 1997) of 14.1 basis points per day, which translates to greater than 35% per year. For short sales kept open longer than five days the estimates of average abnormal returns are not significantly different from zero and the point estimates are close to zero. The returns on short sales by non-hedge fund investors are quite different. Their short sales covered within five trading days actually generate on average a loss of 10.8 basis points per day. Longer-term non-hedge short sales covered within one to three months are only profitable, providing an abnormal return of 2.6 basis point per day or about 6.6%

per year. We obtain similar results by examining the abnormal returns or “alphas” of calendar-time portfolio return regressions using the Carhart (1997) four-factor model.

Having established that hedge fund short trades are profitable, we next test whether the profitability in hedge fund short trades is due to informed trading. Specifically, we examine whether increased short selling activities by hedge funds have predictive power for future negative earnings surprises. For this purpose, we construct short intensity measures for each stock using the ratio of total dollar amounts shorted by all hedge fund managers to the total dollar amounts of all trades by all managers. We find that greater short selling intensity by hedge funds predicts more negative earnings surprises. This predictability of negative earnings surprises is concentrated in short horizons, within five days, which is consistent with our earlier results that hedge fund short trades are profitable for short horizons. Also, hedge fund short trades that are open during earnings announcements and covered within five trades tend to be profitable. In contrast, short selling by non-hedge funds does not show any correlation with firms’ earnings surprises.

We also provide evidence that suggests that some of the hedge fund short sale profits are due to liquidity provision by showing that hedge fund short positions opened on trading dates with positive abnormal stock returns and closed with five trading dates are profitable on average while those opened on trading days with negative abnormal returns are not profitable. There is no evidence that non-hedge fund institutional investors profit from liquidity provision, as non-hedge fund institutional investors on average experience losses on short positions opened on trading dates with positive abnormal stock returns and closed with five trading dates. The point estimates of these losses are actually greater than the losses they suffer on short positions opened on trading dates with negative abnormal stock returns and closed with five trading days.

Lastly, we investigate whether hedge funds have skill in short selling by exploring the extent to which the profits from short selling are persistent. Our data set provides a unique advantage over previous databases to examine short selling skills, since it tracks short trades at the individual manager level, allowing us to track the persistence of the profitability of hedge fund short positions. In particular, we examine whether past successful short sellers who are profitable on their short positions also profit from their short positions in the following periods. We find evidence of such persistence, consistent with the hypothesis that hedge funds possess short selling skills. The hedge funds in the highest quintile of profitability on their previous short

trades continue to execute profitable short trades in subsequent quarters, consistent with having short-selling skill.

These findings are related to several strands of literature. As noted above, Griffin and Xu (2009) and Agarwal et al (2013) find that hedge funds' long equity holdings and disclosed long equity holdings, respectively, display only limited positive abnormal performance relative to the DGTW characteristic-matched benchmarks.⁴ Our finding that hedge fund long trades are not profitable relative to the DGTW characteristic-matched benchmarks is consistent with these results, especially once one recognizes our profitability estimates reflect the transaction costs of entering and exiting the positions and the Griffin and Xu (2009) and Agarwal et al (2013) estimates of abnormal performance do not. More importantly, we add to this literature by documenting that hedge funds earn significant profits on some of their short trades, those closed within five trading days, but not on those held open for longer periods. This finding is consistent with the results in Jame (2015) that U.S. equity hedge funds have short term trading skills and profit from liquidity provision, but that overall the average hedge fund does not earn significant abnormal returns on its equity holdings. Our finding that hedge fund short sales of U.S. stocks held open for long periods are not profitable contrasts with the results in Jank and Smajbegovic (2015) who examine the performance of hedge funds that short sell European stocks using a sample of large short sales in European stocks transacted between November 2012 and December 2014 and find that the hedge funds earn profits.

Overall, our findings that hedge fund long trades are not profitable, short trades closed within trading five days are profitable, and other short trades are not profitable is broadly consistent with the subset of the hedge fund literature that finds limited evidence of superior performance by hedge funds, for example Dichev and Yu (2011), Aiken, Clifford, and Ellis (2013), and Jame (2015).

Our results also add to the literature that investigates what kinds of short sales are informed. Boehmer, Jones, and Zhang (2008) use NYSE data and find that institutional short sales are more predictive of future stock returns than others and Kelly and Tetlock (2014)

⁴ Agarwal et al (2013) report abnormal returns for the disclosed and undisclosed hedge fund positions separately (see their Table V) and not the overall hedge fund portfolios. However, the fact that the aggregate undisclosed position is small relative to the aggregate disclosed position indicates that, aggregating across funds, the abnormal performance of the total hedge fund long equity positions is similar to the performance of the disclosed positions. Agarwal et al (2013, Table V) do find some evidence of positive abnormal performance using the "alphas" from calendar-time regressions using the four-factor Carhart (1997) model.

examine short selling by retail investors, but how particular types of institutional investors, for example hedge funds, perform on their short sales has not previously been studied.

Finally, our results are related to the broader literature showing that short interest and other proxies for short-selling activity predict stock returns cited above. As pointed out previously, the ability of measures of shorting activity to predict stock returns does not imply that shorting is profitable because short sellers might incur significant price impact costs in unwinding their trades, especially if the trades are crowded (Hong et al 2015). Our results suggest that the caveat that predictability does not imply profitability is important.

2. Data and Variable Construction

Our analysis of hedge fund short sales requires that we match the institutional investor transactions data from ANcerno to the holdings data from the Form 13F filings. We describe the transactions data and how we match it to the Form 13F holdings data, and then explain how we classify the institutions' transactions as short sales, short buys, long buys, and long sells.

2.1. Institutional Trading Data from ANcerno

The transaction-level institutional trading data are from ANcerno (formerly Abel/Noser), an execution cost consulting firm. The data cover the period from January 1999 to September 2011 and are representative of institutional investor transactions.⁵ Versions of the dataset have previously been used by Bethel et al. (2009), Chemmanur et al. (2009), Goldstein et al. (2009), Hu (2009), Green and Jame (2011), Anand et al. (2012), Agarwal et al. (2014), Green et al. (2014), and Hu et al. (2014). Fields in the dataset include detailed information on institutional stock transactions including CUSIP and ticker identifiers, the transaction date, the number of shares transacted, whether the transaction is a buy or a sell, and the transaction price. Unlike most other research using ANcerno data, our version of the dataset includes the names of the institutional managers who execute the transactions. This enables us to use the names to merge the ANcerno data with the 13F holdings data and construct estimates of the institutional investors' positions on each date, and thus identify whether the transactions (changes in positions) are short sales, short buys, long buys, or long sells.

⁵ For example, the version of the "Universe Profile" (ANcerno 20xx) we have describing the dataset indicates that over the period from the fourth quarter of 2009 to the third quarter of 2010 the dataset includes data on trades of 133 billion shares with total market value of \$3.4 trillion in over 8,390 stocks and ADRs.

2.2. Merging the Transaction and Holdings Data

We match institutional managers in ANcerno with those in the 13F holdings data by comparing both the quarterly changes in holdings computed from the two datasets and the manager names. Specifically, for each combination of stock and quarter we begin by computing the holdings changes from the beginning to the end of the quarter by cumulating the transactions reported in the ANcerno data. We then compare the holdings changes computed from the ANcerno data to the holdings changes computed directly from the 13F holdings, and use the approach and criteria in Hu, Ke, and Yu (2011) to identify for each ANcerno investment manager the ten managers in the 13F data for which the 13F holdings changes most closely match the ANcerno holdings changes.⁶ Having identified the ten most closely matching managers based on the holdings changes, we then “manually” compare the manager names to find a match that is exact up to abbreviations and minor variations in the manager names. If we do not find a match based on names among the ten 13F managers identified using the holdings changes then we do not use the data for that ANcerno manager. By matching on both names and quarterly changes in holdings we ensure that the managers in the ANcerno data and the 13F filings are the same and that the ANcerno data captures close to all the trades made by the managers during the quarter. Our procedure for matching changes in holdings is similar to that in Hu, Ke, and Yu (2011). The difference between our approach and theirs is that they do not have ANcerno manager names and for that reason map each ANcerno client identifier (ANcerno variable *clientcode*) to the single 13F manager whose holdings changes must closely match the changes in holdings computed by cumulating the ANcerno transactions.

Before matching on holdings we filter the ANcerno data according to the following criteria used by Hu, Ke, and Yu (2011). If an ANcerno manager does not have trades in every month of a given quarter, the manager trades for the quarter are dropped. We require that the manager have trades in every month of the quarter in order to screen out managers who enter or exit the ANcerno database during a quarter and managers who do not report their trades for every month, because in these cases their cumulative transactions will not be for a full quarter and cannot be expected to match the changes in holdings computed from the 13F data. Second, for each combination of firm and calendar quarter we retain only those that have the following

⁶ We do not expect to obtain always obtain exact matches due to possible errors in the ANcerno and 13F holdings data.

characteristics: (a) the firm must be a U.S. firm that issues only one class of common stock traded on one of the three major stock exchanges; (b) the stock does not split, get delisted, or undergo an initial public offering during the quarter; (c) the stock price at the beginning of the calendar quarter is greater than \$5 and the number of common shares outstanding at the beginning of the calendar quarter is greater than one million; (d) the net quarterly institutional ownership change is greater than 500 shares; and (e) the firm must have institutional trading or holdings data in both databases (though not necessarily by the same institutions).

After filtering the ANcerno data, for each ANcerno manager we consider each 13F manager, and count the number of firm-quarters for which the holdings changes computed from the ANcerno data match the holdings changes computed from the 13F data. Dividing this count by the number of available firm-quarters for the ANcerno manager, for each ANcerno manager the result is a ranking of how closely the holdings changes of each of the 13F managers match the holdings changes of the ANcerno manager. We also construct an alternative ranking in which we count the number of firm-quarters for which the absolute difference between holdings changes computed from the ANcerno data and the holdings changes computed from the 13F data is less than ten percent of the absolute value of the change in holdings computed from the ANcerno data. Using these two rankings, for each ANcerno manager we select the ten most closely matching 13F managers. Finally, for each ANcerno manager we examine the names of the ten mostly closely matching 13F managers to find a match that is exact up to abbreviations and minor variations in the manager names.⁷ Using this procedure we are able to match 194 ANcerno managers to the managers reported in the 13F filings.⁸

We identify management companies as hedge funds based on their SEC Form ADV filings, following the approach in Jame (2015). We classify a management company (asset

⁷ As indicated above, Hu, Ke, and Yu (2011) did not have the ANcerno manager names and thus did not match on names. Instead, they used the changes in holdings to find the 13F manager whose changes in holdings most closely matched the holdings changes of the ANcerno managers.

⁸ The ANcerno dataset has 862 managers. One of the manager codes (clientcode) is not a valid code and we exclude the data from that manager from the analysis, leaving 861 potentially identifiable managers. Some managers buy and sell the same number of shares in a given stock in the same day, and we exclude these managers because we are interested in daily positions. The number of potentially identifiable managers in the dataset, with a non-zero net daily trade at some point, is 839. Part of the algorithm in Hu, Ke, and Yu (2011) that we use to match the ANcerno and 13F data involves 1) only keep trades where managers trade every month in a quarter and 2) where the net quarterly trade is more than 500 shares. This reduces the number of managers that could be matched to 13F to 789. Further restrictions from the Hu, Ke, Yu (2011) algorithm result in 645 managers being included in the list of possible matches to 13F managers. Of these 645 managers, 194 are then matched by name to the 13F holdings data.

manager, or fund company) as a hedge fund if first, item 5D of Form ADV indicates that more than half of the management company's investors are high net worth individuals or pooled investment vehicles and second, item 5E of Form ADV indicates that the management company charges a performance fee. Of the 194 ANcerno managers that we match to 13F managers, we identify 53 as hedge funds and 141 as non-hedge fund investment managers.

2.3. *Classifying Transactions as Short Sells, Short Buys, Long Buys, and Long Sells*

After matching the ANcerno investment managers to the managers in the 13F filings we combine the manager positions reported in the 13Fs with the transactions (changes in positions) from the ANcerno data to construct estimates of the holdings of each manager in each stock on each date. Once we know the managers' positions in the various stocks on each date we can easily identify the transactions as short sales, short buys, long buys, and long sells. For example, we identify a decrease in a non-positive position as a short sale, and an increase in a negative position as short covering, that is as a short buy. Similarly, an increase in a non-negative position is a long buy and a decrease in a positive position is a long sell.

It is straightforward to estimate manager A 's holdings in stock X for each date as long as the manager A reports holdings in stock X for at least one quarter-end date. However, it is possible that ANcerno reports transactions by a manager in stock X but the manager never files a 13F reporting holdings of stock X because the manager's position never meets or exceeds the Form 13F reporting threshold of 10,000 shares or \$200,000. In this case we can construct upper bounds on the manager's positions in stock X on each date by using the fact that manager A 's maximum position in stock X across all dates must have been less than the reporting threshold.

Let $I(t, A, X)$ represent the estimate of the inventory of ANcerno manager A in stock X at the end of trading day t . Negative values of $I(t, A, X)$ mean A has an open short position in stock X . For each date t for which a manager A Form 13F reports a position in stock A we set $I(t, A, X)$ equal to the number of shares listed in the 13F. We then use the ANcerno data to assign values to $I(t, A, X)$ on trade dates between 13F filings, before and after the first and last 13F filing reporting holdings in stock X , and if manager A never reports holdings in stock X . For each combination of manager A and stock X there are four cases: (1) dates t that fall between two end of quarter dates for which manager A reports holdings of stock X ; (2) dates t that are before the date of manager A 's first 13F that reports holdings of stock X ; (3) dates t that are after the date of

manager A 's last 13F that reports holdings of stock X ; and (4) manager A never reports a holding of stock X .

Case 1: Dates t that are in between two quarter-end reporting dates for which manager A reports holdings of stock X

Let $t_n, n = 1, 2, \dots, N$ be the dates for which manager A has filed Form 13F. Consider a date t falling in between two quarter-end reporting dates for which managers A 's 13F filings report holdings in stock X , and let t_m and t_n be the latest quarter-end before date t and earliest quarter-end after date t for which manager A 's Forms 13F show a holding in stock X , respectively. The dates t_m and t_n need not be consecutive quarter-end dates. Let $I_1(t, A, X)$ be the estimate of the inventory of A in stock X at time t computed from the number of shares in stock X reported in the 13F for date t_m , incremented and decremented by the buys and sells reported in the ANcerno data, and let $I_2(t, A, X)$ the estimate of the inventory of A in stock X at time t computed from the number of shares in stock X reported in the 13F at date t_n , incremented and decremented by the sells and buys reported in the ANcerno data. In both cases we adjust for stock splits when incrementing and decrementing the inventories. If the two estimates based on the reported holdings at t_m and t_n agree then we set $I(t, A, X) = I_1(t, A, X) = I_2(t, A, X)$. It is also possible that $I_1(t, A, X)$ and $I_2(t, A, X)$ do not agree due to errors in either the ANcerno or 13F holdings data; in this case we estimate $I(t, A, X)$ as a weighted average of $I_1(t, A, X)$ and $I_2(t, A, X)$, that is we set

$$I(t, A, X) = w \times I_1(t, A, X) + (1 - w) \times I_2(t, A, X), \quad (1)$$

where $w = (t_n - t)/(t_n - t_m)$.

Case 2: Dates t prior to the first date for which manager A reports holdings of stock X

Let t_n be the earliest quarter-end date after t for which manager A has filed a 13F reporting a position in stock X . For dates $t < t_n$ the inventory $I(t, A, X)$ is computed by starting from the number of shares in stock X reported in the date t_n 13F, $I(t_n, A, X)$, and incrementing and decrementing that value using the sells and buys reported in the ANcerno data.

Case 3: Dates t after the last date for which manager A reports holdings of stock X

Let t_m be the latest end of quarter date before t for which a manager A Form 13F reports holdings in stock X . For dates $t > t_m$ the inventory $I(t, A, X)$ is computed by starting from the number of shares in stock X reported in the 13F at date t_m , $I(t_m, A, X)$, and incrementing and decrementing that value using the buys and sells reported in the ANcerno data.

Case 4: Manager A does not report holding stock X

If none of manager A's 13Fs report holdings in stock X but the ANcerno data show that A trades in stock X , we calculate the relative holdings, $RI(t, A, X)$, of manager A in stock X by assuming that manager A 's initial holding of stock X over the date range of the ANcerno dataset is zero. That is, if the first transaction in the ANcerno data has A buying 200 shares of X at time t , then $RI(t, A, X) = 200$. After calculating $RI(t, A, X)$ we then adjust the values so that the maximum inventory over the entire period for which ANcerno data are available for that manager is zero, that is we set $I(t, A, X) = RI(t, A, X) - \max_t \{RI(t, A, X)\}$. This results in overestimating manager A 's inventory of stock X on each date, as it sets each value $I(t, A, X)$ equal to the maximum possible value that is consistent with manager A never reporting a long position in stock X .

2.4. Identifying Short Sales, Short Buys, Long Sales and Long Buys

Using the estimates of $I(t, A, X)$ we are able to identify short positions and short sales. A has a short position in stock X when $I(t, A, X) < 0$. A short sale occurs when $I(t, A, X)$ is initially non-positive and the net number of daily shares bought in X is negative. Using a similar approach we are able to identify daily transactions as short buys, long sells and long buys. A short buy occurs if $I(t, A, X)$ is initially negative, the net number of shares bought in X is positive and the new value of $I(t, A, X)$ remains negative. A long buy occurs if $I(t, A, X)$ is initially non-negative, and the net number of shares bought in X is positive. A long sell occurs if $I(t, A, X)$ is initially positive, the net number of shares bought in X is negative, and the new value of $I(t, A, X)$ remains positive.⁹ This classification scheme allows for short buys and long buys to occur on the same date, as well as long sells and short sells. Once we have the number of shares in short sales, we calculate the dollar volume short sold by multiplying the number of shares in the short sale by the closing day price.

Summary statistics of the trade classifications are presented in Table 1. The ANcerno data has 10,368,220 net daily stock-manager trades. Long buys are the majority of the daily trades with a sample size of 4,744,899; followed by long sells (4,707,011), short sells (547,667), and short buys (461,565). Short sells consist of 5.3% of the sample trades. For hedge fund only

⁹ If the daily change is from holding x shares to a short position of y shares, we treat this as a long sale of x that brings the long position to zero and a short sale of y shares. Similarly we treat a change from a short position of x shares to a long position of y shares as a short buy of x shares and a long buy of y shares.

transactions, of the 2,588,401 net daily stock-hedge fund trades; 1,145,713 are long buys, 1,164,148 are long sells, 168,813 are short sells and 137,270 are short buys. Short sells consist of 6.5% of the sample hedge fund trades.

3. Short Sales During the Short Sale Ban: A Reality Check on Our Identification of Short Sales

3.1. Hedge Fund Short Sales during the Short Selling Ban.

In an effort to “protect the integrity and quality of the securities market and strengthen investor confidence,” the Securities and Exchange Commission (SEC) banned short selling in a list of financial companies starting on September 19, 2008.¹⁰ This short sale ban remained in effect until short sales of financial sector stocks were allowed to resume on October 9, 2008. Prior to the announcement of the short sale ban, on September 17, 2008, the SEC banned naked short selling in all stocks.¹¹ We check our classifications of trades by examining the estimated short sales of financial sector stocks during this period when short sales of financial stocks were banned. Our algorithm, if correct, should identify short selling by hedge funds as close to zero during this period.

Panels A of Figure 1 show estimates of hedge funds’ dollar volume of short sales and long sales, respectively, during September and October 2008. On September 18, just prior to the announcement of the ban, we estimate that hedge funds had an average of just over \$25 million in short sales proceeds. Then at the onset of the ban the average dollar value of shares sold short drops steeply to close to zero.¹² The average dollar value of financial shares short sold remains close to zero until the ban is lifted on October, 9, on which date the average dollar volume short sold by hedge funds rises dramatically to slightly over \$40 million. While the ban was intended to halt the slide in the price of financial stocks, in actuality the ban resulted in a short run bump to prices, but by the end of the ban, the financial sector was down nearly 26%.¹³ We estimate that there was a dramatic decline short sales on the implementation of the ban and an even greater

¹⁰ See <http://www.sec.gov/news/press/2008/2008-211.htm>. The ban was announced after the close of trading on September 18, 2008, and was effectively immediately.

¹¹ See http://money.cnn.com/2008/09/17/news/companies/sec_short_selling/ [can we find the SEC release?]

¹² The reason the graph does not show short selling falling to \$0 during the 09/19/08 to 10/08/08 period is SEC banned short sales in 799 financial companies. We examine short selling in all financial companies based on SIC code.

¹³ See <http://www.wsj.com/articles/SB122351280409217645>

increase in short sales at the end of the ban. Our algorithm produces results that are consistent with financial events.

We also illustrate, in Panel B, the dollar-value of long selling by hedge funds in financial stocks. Following the short sale ban, and the temporary increase in the price of financial stocks, hedge funds reduce their long selling in financial stocks. However, unlike the drastic reduction in short sales, the average dollar volume of long sales on September 19 is \$275 million –i.e. long selling does not fall anywhere close to \$0 on 09/19/08. During the period of the short sale ban, the long selling by hedge fund increases as financial stock prices decline. Average long sales by hedge funds reach \$163 million on September 29, 2008. When the ban on short sales in financial stocks is lifted on October 9, the proceeds from long sales drop significantly from \$157 million the previous day to approximately \$25 million as hedge funds resume short selling. The differences in short selling and long selling trading activity by hedge funds during the short sale ban are indicative that our algorithm correctly identifies short sales.

Panels C and D of Figures 1c and 1d present non-hedge fund institutional investors' dollar volume of short sales and long sales in financial stocks over the short sale ban period. The trading activities of institutional investors are similar to hedge funds over the short sale ban. This suggests that we are also able to correctly distinguish between institutional investor's short sales and long sales. Similar to hedge funds, we find institutional investors' short sales in financial stocks drop significantly once the short sale ban is enacted, and rises sharply once the ban is repealed. However, the average short sales by institutional investors are higher than hedge funds during the ban period. This result is consistent with Boehmer et al. (2013). They find that during the shorting ban, short sales do not decline to zero as institutional investors, such as market makers, were able to short sell during the ban. Similar to hedge funds' trading activity, we show that institutional investors' long sales decrease following the ban, but the decrease is not as steep, and the long sales continue to decline once the ban is repealed. Institutional investors exhibit different short selling and long selling trading activity during the short sale ban.

3.2. Hedge Fund Short Sales and the Great Recession

We further examine the hedge fund short sales during the 2008 Great Recession. Figure Panel A illustrates the selling activity of hedge funds from January 2007 through June 2009. We

map our identified short selling activity against events during the financial crisis. The timeline of events during the Great Recession is quoted from the Federal Reserve Bank of St. Louis.¹⁴

Short selling by hedge funds reaches its lowest average dollar value on September, 2007 and its highest value on October 2008. October, 2008 was the peak of the Great Recession. There is an increase in short selling by hedge funds in 2007, just prior to Bear Sterns June 2007 disclosure of losses from its subprime mortgages investments.¹⁵ The overall trend of short selling by hedge funds during the Great Recession is upward. Following the peak of the Great Recession and the subsequent market recovery (November 2008 and onwards), there is a sharp decline in hedge fund short selling. While there is an overall trend in hedge fund short selling (increasing as the market declines, decreasing as the market improves), the intermittent movements in short selling can be attributed to actions by the Securities Exchange Commission (SEC). For example, in July 2008 the SEC issues an emergency order temporarily prohibiting naked short selling in the securities of Fannie Mae, Freddie Mac, and primary dealers at commercial and investment banks and we observe a decline in hedge fund short selling in July, 2008. Overall, our calculated short selling by hedge funds is consistent with what one will expect during the financial crisis.

In contrast, our calculated long selling by hedge funds (Figure 2 Panel B) does not demonstrate similar patterns during the Great Recession. Hedge fund long selling appears to decline over period of the Great Recession as opposed to illustrating an upward time trend. These differences between hedge fund short selling and long selling show that we are able to distinguish short sales from long sales. The fact that our calculated short sales mirror behavior that is expected throughout the Great Recession adds credence to our algorithm correctly identifying short sales.

4. The Profitability of Hedge Fund Short Sales

There is an extensive literature documenting that short interest and other measures of shorting activity predict stock returns. Most these studies, however, rely on aggregate measures of shorting activity and do not have access to account-level data, and do not examine actual profitability of short sales. Although suggestive, the finding that short sale activity predicts stock returns does not imply that it is profitable. Investors might close their short positions at

¹⁴ See <https://www.stlouisfed.org/financial-crisis/full-timeline>

¹⁵ On June 2007, Bear Stearns restructured its High-Grade Structured Credit Strategies Enhanced Leverage Fund.

unfavorable times, or the price impact of their short covering trades might reduce the trades' profitability. This is likely if the short trades are "crowded," as point out by Hong et al. (2015). An advantage of our data over previous databases is that we can determine when investors open and close their trades and thus compute the profitability of the trades. Below we present the profitability of trades that are open for various lengths of time or trade lengths.

4.1. Calculating Trade Length

We compute trade profitability from closed trades. Specifically, for each short buy transactions in our data, we identify the most recent short sell trades that correspond to the short buy transactions. We count the short buy (closing) and corresponding short sell (opening) transactions as a completed trade, and compute the trade length and profitability from these transactions. For example, suppose a manager has a short position of 300 shares in a stock and buys back 100 shares (that is, a short buy of 100 shares) on January 12, 2005, at which time the short position becomes 200 shares. We then trace back from January 12 to find the most recent short sales that contributed to the short position of 300 shares. If there are multiple such short sales on different dates, we assign all these dates as separate opening dates. For example, if the short position goes from 100 to 200 on January 5, 2005 and 200 to 300 on January 6, 2005 so that the most recent short sales are the two 100-share transactions on January 5 and 6, we treat these as two short trades, one opened on January 5 and closed on January 12 and one opened on January 6 and closed on January 12. In this sense, our calculations are based on a last-in-first-out (LIFO) rule. We use the LIFO rule because it seems reasonable, but also because other rules such as first-in-first-out (FIFO) are not feasible because we do not observe the opening dates of trades that were opened before the investment managers entered the ANcerno dataset. Rather than arbitrarily assuming a starting date of a stocks short position, looking at the most recently opened position compared to neighboring closing transaction allows a more consistent measure of trade length across the shorted stocks.

For the analyses in this paper, based on the trade length measure, we only include short sell observations with computable trade length of less than one year. This restriction reduces our short sale sample by 20%. Due to the sample period having defined starting and ending dates, 20% is an upper bound on the fraction of short trades that have trade length of more than a year. Since our focus of analysis is in the profitability of short sale trade that are covered in less than one year, excluding these observations does not compromise our conclusion.

Table 2 provides the summary statistics of the trade lengths that are less than one year. Panel A compares average short side trade lengths of funds and non-hedge fund investors. Hedge fund managers' average short side trade length is 50.80 days, 2.84 days shorter than the non-hedge fund investor's trade length of 53.64 days. Panel B shows the distribution of long side trade lengths for the hedge fund and non-hedge fund managers. On average, hedge fund managers' long side trade length of 58.43 days is 2.09 days greater than the non-hedge fund investors' long side trade length of 56.33 days. In both cases the difference in average trade length are statistically significant. Hedge funds are somewhat faster to cover their short positions and slower to cover their long positions as compared to non-hedge fund investors.

4.2. Are Hedge Fund Short Sales Profitable?

We form four value-weighted portfolios of shorted stocks based on ranges of the stocks' trade length (trade length ≤ 5 days, $5 \text{ days} < \text{trade length} \leq 21$ days, $21 \text{ days} < \text{trade length} \leq 63$ days, and $63 \text{ days} < \text{trade length} \leq 252$ days) for hedge funds and a corresponding four value-weighted portfolios for the non-hedge fund investors. Stocks are kept in their portfolio from the opening to the closing of the short trade. Portfolio weights are based on the dollar amounts shorted, and we calculate abnormal stock returns by benchmarking to the size, book-to-market, and momentum characteristics-matched portfolios proposed by Daniel, Grinblatt, Titman, and Wermers (DGTW, 1997).

Panel A of Table 3 reports DGTW-adjusted returns on the four portfolios with different trade lengths for hedge funds (HF) and non-hedge fund managers (NHF). Hedge funds have strong profitability for short positions covered in less than five trading days. We find the average DGTW-adjusted return on this portfolio is negative 14 bps per day with a t -statistic of -2.36 , which indicates that the short sale portfolio is highly profitable. (The returns we report are the returns to long positions, so a negative return implies that the short trade was profitable.) In contrast, non-hedge funds exhibit negative profitability in short trades with trade length less than or equal to five days. The average return on this portfolio is positive 11 bps per day, which is statistically significant at the 5% level. Thus, non-hedge fund managers lose money on their short-horizon short sales. For the longer horizon of between one and three months non-hedge fund investor short-sale portfolios are profitable with an average return 2.6 bps per day, which translates to approximately 6.6% per year. In sum, the results in Panel A show strong

profitability for hedge fund short sales only for the short-term trades with trade length less than or equal to five days.

Panel B reports abnormal returns (alphas) on the trade length portfolios estimated using the Carhart four-factor model (Carhart 1997). The results based on the four-factor alphas are consistent with those in Panel A based on DGTW-adjusted returns. Hedge fund portfolios exhibit negative alphas only for short-term trades. The estimated alpha from the four-factor model is -14 bps per day daily with a t -statistic of -2.29 . In contrast, the non-hedge fund short sale portfolio in the short horizon portfolio with a trade length of less than or equal to five days shows a positive alpha of 13 bps per day, consistent with the results based on DGTW-adjusted returns that non-hedge fund investors tend to lose money on short-horizon short sales. In the longer horizon of one to three months, however, non-hedge fund investor trades become profitable, as can be seen from the alpha of -2.8 bps per day with a t -statistic of -2.17 .

The bottom two rows of the table report alphas based on Dimson (1979) sum betas and the four-factor model as a check to confirm that the results for the four-factor alphas are not driven by non-synchronous trading. These results based on Dimson betas are consistent with the previous alphas reported above. In addition, in untabulated results we estimate alphas for equal-weighted TL portfolios and obtain qualitatively similar results. Overall, the results in Table 3 Panels A and B show that hedge funds' short horizon short trades are highly profitable. Intermediate horizon trades of non-hedge funds are also profitable, but with considerably smaller average daily returns.

Table 4 explores the profitability of the long side trades of the hedge fund and non-hedge fund investors. Similar to the short sale portfolios, we place the long side trades into value-weighted portfolios based on their trade lengths. Panels A and B report average DGTW-adjusted returns and alphas from the four-factor models, respectively, for hedge fund and non-hedge fund investor long trades.

The results in Table 4 provide no evidence that hedge fund long trades are profitable. In Panel A, the point estimate for the DGTW-adjusted returns on the portfolio with trade length less than or equal to five days is 3.1 bps per day, consistent with these short-term trades being profitable, but the t -statistic is only 0.98 . The average returns for the other three hedge fund portfolios are either negative or close to zero, with the average return on the portfolio with trade length of between 21 and 63 days actually being significantly negative. The four-factor model

alphas in Panel B are in line with the average DGTW-adjusted returns in Panel A. Overall, the hedge fund results in Table 4 are consistent with previous studies such as Griffin and Xu (2009), who find limited evidence that hedge funds' long positions have positive abnormal returns.

The profitability of the non-hedge fund investors' long side trades is lesser than that of the hedge fund trades for all four trade length portfolios. For example, the average DGTW-adjusted return non-hedge fund investors' trades with trade length less than or equal to five days is -19.3 bps with a t -statistic of -13.86 , and the corresponding alpha in Panel B is -22.6 bps with a t -statistic of -14.07 . All of the other point estimates of the average abnormal returns on non-hedge investor portfolios are also negative, though not all are significantly different from zero.

In summary, we find that hedge funds are profitable on their short positions especially for short-horizon trades. They earn approximately 14 bps per day on their short positions, which translates to almost 35% annum. The point estimates of the abnormal returns on the longer term short trades also are consistent with profitability, though the magnitudes are small and the estimates are not significantly different from zero. In contrast, we find no significant positive performance for non-hedge funds on short positions and in particular for their short-horizon trades. Although hedge funds' short-term short sales have strong profitability, we find no evidence that their long trades are profitable in our sample.

4.3. Are Hedge Funds Informed Short Sellers?

The results in the previous section show that hedge funds' short-term short trades are profitable. A natural question that arises is what is the source of their profitability? Here we explore one possible event about which hedge funds might have information by exploring whether their trading prior to earnings announcements predicts earnings surprises. In this, we focus on whether hedge fund short selling predicts negative earnings surprises, which are typically associated with negative stock returns. Thus, if hedge funds are informed traders we expect that hedge funds will short stocks before negative earnings surprises.

To test this hypothesis, we estimate the regression model

$$ES_{i,\tau} = \alpha + \beta_1 SSI_{i,t} + \beta_2 SBI_{i,t} + \beta_3 LSI_{i,t} + \beta_4 LBI_{i,t} + Controls_{i,t} + \varepsilon_{i,t} . \quad (2)$$

The earnings surprises ($ES_{i,\tau}$) for firm i in quarter τ is the difference between the earnings per share announced and the corresponding consensus analyst forecast, normalized by the share price five trading days before the announcement (DellaVigna and Pollet 2009). The main explanatory

variables are short sale intensity, ($SSI_{i,t}$), short buy intensity, ($SBI_{i,t}$), long sell intensity, ($LSI_{i,t}$), and long buy intensity, ($LBI_{i,t}$). $SSI_{i,t}$ is defined as $\sum_j SSI_{i,j,t} / \sum_j (SSI_{i,j,t} + SBI_{i,j,t} + LSI_{i,j,t} + LBI_{i,j,t})$ where $SSI_{i,j,t}$, $SBI_{i,j,t}$, $LSI_{i,j,t}$, and $LBI_{i,j,t}$ are the dollar volumes of short sells, short buys, long sells, and long buys by manager j respectively. $SBI_{i,t}$, $LBI_{i,t}$, and $LSI_{i,t}$ are calculated similarly. Short sales intensity captures the degree or intensity of short selling in a stock on a given trading day by all managers. This variable is a proxy of the overall managers' view on a given stock. Greater short selling by managers in the stock will result in a higher Short Sales Intensity. In order to examine how soon before an event hedge funds become informed we compute the measures using trading volume from two different windows prior to the earnings announcements. We use average short intensities during one week before earnings announcement ($\tau - 5, \tau - 1$) and during the period between one and four weeks before earnings announcement ($\tau - 21, \tau - 6$). In selecting the control variables for our regression, we follow Fama and French (2006) and include a dummy variable indicating negative previous earnings (NEGE), dummy variables indicating negative (ACC-) and positive accruals per share (ACC+), percent change in total assets (AG), a dummy variable indicating zero dividends (DD), dividends per share (DPS), and log book-to-market (BE/ME). The regressions are pooled and standard errors are clustered by date and firm. If hedge funds are informed short sellers then there should be a negative relationship between short sale intensity, ($SSI_{i,t}$) and earnings surprises.

Table 5 reports the results of regressing earnings surprises on the various measures of buy and sell intensities. We find that higher hedge fund short sale intensities predict lower earnings surprises within five days. For example, the coefficient on the hedge fund short intensity during the week before the earnings announcement is -0.163 . The economic significance is substantial; a one-standard-deviation increase in short sell intensity (0.409) is associated with a 6.67% decrease in the earnings surprise. The t -statistic is -1.83 and significant only at the 10% level, because of the small sample size associated with earnings announcement events. In contrast, none of the other intensities (i.e., SBI , LSI , and LBI) are statistically significant at the 10% level. Also the predictability of earnings surprises by hedge funds are concentrated in the short horizon (less than or equal to five days), which is consistent with the profitability results presented in Table 4. Interestingly, we also find that non-hedge funds' short sales are predictive of future earnings surprises for both long and short horizons. In sum, we find that hedge funds' short trades can forecast future earnings surprises.

In Table 6, we further examine whether hedge funds are able to earn higher profits during earnings announcement periods by comparing short positions that are open before announcement and closed after the announcement to short positions that are not open during earnings announcements periods. For both short positions, we form two portfolios based on trade length: one for trades length less than or equal to five trading days ($TL \leq 5$ days) and the other for trade length greater than five and less than or equal to twenty one trading days ($5 < TL \leq 21$). A few observations are in order. First, we find that hedge funds' short sale profitability is slightly stronger during earnings announcement periods. Although the difference is not statistically significant due to the small number of observations (293), the returns on the short positions during earnings announcement periods is -15.8 bps in contrast to -12.7 bps during non-earnings announcement periods. Second, we do not find any significant profitability of hedge fund short positions for long-horizon trades ($5 < TL \leq 21$). Lastly, non-hedge funds' trades are not significantly profitable for any horizons during earnings announcement periods. In sum, hedge funds short term profitability is higher during periods of earnings announcement, suggesting that hedge funds are informed short sellers.

Overall, our results in Tables 5 and 6 suggest that hedge funds' short sales predict future negative earnings surprise and suggest that hedge funds are informed short sellers. Note also that the results in Table 6, that hedge funds earn returns of 12.7 bps per day during non-earnings announcement periods, indicate that hedge funds are also profitable during non-earnings seasons, indicating that informed trading about earnings information is not the only source of hedge fund profitability.

4.4. Are Hedge Funds Profitable Short Sale Liquidity Providers?

In this section, we examine whether hedge funds obtain profits from their short selling by acting as liquidity providers. Diether et al. (2009) find that short sellers increase their short selling following positive returns. The advantage of our dataset is that it allows us to identify when short positions are opened and also closed. Thus, we can examine whether short sellers provide liquidity not only when they initiate trades but also when they close them.

To proxy for liquidity providing short sales, we use short trades that are initiated when contemporaneous daily returns are positive. Temporary buying pressure on a stock will cause short-term appreciation in stock prices that will subside over the next few days. As Diether et al. (2009) note, short sellers might step in to provide liquidity by opening short trades, attempting to

profit when the buying pressure dissipates and prices converge to fundamental levels. These short sellers can also provide liquidity by covering their positions when other traders sell and push down prices to fundamentals. To examine this liquidity provision through short coverings, we use short buy trades when stock returns are negative on short covering days.

Table 7 presents results that help answer whether the profitability of hedge fund short sales is associated with liquidity provision by opening short trades. We sort trades with trade length less than or equal to five days into two value-weighted portfolios based on whether the DGTW-adjusted return to the stock on the day the short position is opened is positive or negative. Stocks are held in the portfolio from the opening day until the closing day of the short trade. We observe in Panel A that hedge fund short sales are profitable only when contemporaneous stock returns on short opening days are positive. This result is robust to controlling for factor returns. In Panel B, the alpha estimate is -23.2 bps daily with a t -statistic of -3.05 , showing that the profitability is significant both economically and statistically. The difference in returns between positive and negative contemporaneous return days is also quite substantial, -31.2 bps with a t -statistic of -3.09 , as shown in Panel A. In contrast to hedge funds, we find that non-hedge fund short sales are not particularly profitable when short opening day returns are positive.

We next use the uniqueness of our dataset to examine whether the profitability of short covering is associated with liquidity provision. In Table 8, we further split short portfolios that we report in Table 7 into portfolios with positive versus negative returns on short covering days. We find that the profitability of hedge fund short sales is almost entirely concentrated on days when stock returns are negative on short covering days. For example, hedge fund returns are striking -1.299% per day on short positions that are opened when stock returns are positive and that are covered when stock returns are negative. Even for short trades that are opened during negative return days and thus are not likely to be associated with liquidity provision, the short side profitability is -1.033% per day if short covering day returns are negative. In contrast, we find the short side returns are all positive when covering day returns are positive. We find similar results for non-hedge funds, albeit to a lesser extent. In sum, we find that profits to short sellers acting as liquidity providers come mainly from short sellers closing their position. We also find that both hedge funds and non-hedge funds obtain profits by closing their short sales on days when the daily stock return is negative.

Tables 7 and 8 provide evidence that hedge funds' profits from short selling are also due to hedge funds acting as liquidity providers. When there is excessive buying pressure on a stock, on a day when the stock's return is positive, hedge funds open their short position. They provide liquidity for the buying pressure. Hedge funds close their short positions on days when the stock's return is negative, thereby obtaining a profit on their liquidity providing trade.

4.5. Is Hedge Fund Short Sale Profitability Persistent?

In this section, we test whether hedge funds are skilled short sellers by examining the persistence of hedge fund short sale profitability. Each quarter, we separately rank the hedge fund and non-hedge fund investment managers based on the past year's performance on their short positions. Then following Daniel, Grinblatt, Titman, and Wermers (1997), we group them into five hedge fund manager quintiles and five non-hedge fund manager quintiles. Next, we compute the value-weighted abnormal return on the managers' short positions with trade length less than or equal to five days and trade length greater than five days for the next four quarters. Finally, we compute equal-weighted averages of the managers' value-weighted returns.

Panels A and C of Table 9 show the results for the hedge fund trades with trade length less than or equal to and greater than five days, respectively, while Panels B and D presents the corresponding results for the non-hedge fund trades. In each Panel, the first column of results headed "Formation Period" presents the average DGTW-adjusted returns during the formation period, and the four columns headed "Q1," "Q2," "Q3," and "Q4" show the average returns in the four quarters following the end of the formation period. Portfolio 1 consists of the managers that had the most profitable short positions during the formation period and Portfolio 5 consists of the managers that had the least profitable short positions during the formation period.

The results in Panel A indicate that the profitability of the short positions of the hedge funds that were most profitable during the portfolio formation period is lower during the subsequent four quarters than it was during the portfolio formation period, which is unsurprising, but the point estimates indicate continued profitability in all four quarters and that the estimate in the column headed "Q4" is significant. The profitability of the short positions of the hedge funds that were least profitable during the portfolio formation period is higher during the subsequent four quarters than it was during the portfolio formation period, which is again unsurprising, but the point estimates indicate continued losses and the estimates in the columns headed "Q1" and "Q2" are significant at the 5% and 1% levels, respectively. The difference between the low and

high quintile portfolios are negative in all the next four quarters (Q1 through Q4) and statistically significant in three out of four quarters with t -statistics of -2.19 , -2.21 , and -3.39 for Q1, Q3, and Q4, respectively. The economic magnitudes are also quite sizable with daily returns ranging between -42.4 bps and -96.8 bps per day. These results indicate that the short-sale performance is persistent, which is consistent with it being due to skill.

In contrast, the results for non-hedge fund investors' short-term trades (trade length less than five days) in Panel B and the longer term hedge fund trades (trade length greater than five days) in Panel C provide little evidence of persistence. In these two panels the differences "Low – High" are not all negative and only one of the differences, that in the column headed "Q3" in Panel B, is significant. The limited evidence of persistence that is found appears to come from persistence of poor performance, as the non-hedge fund investors that performed most poorly during the portfolio formation period (quintile 5) continue to perform poorly during the third and fourth quarters after portfolio formation with t -statistics of 1.98 and 1.71 , respectively.

Panel D showing the results average DGTW-adjusted returns of for the non-hedge fund investor portfolios with trade length greater than five days provides some limited evidence of persistence. The bottom row "Low – High" shows significant estimates in the two columns headed "Q3" and "Q4." However, these results are primarily due to non-hedge funds with the lowest returns over the past year continuing to have greater losses over the next four quarters than institutions in the remaining quintiles—all of the average returns for quintile 5 are significant, and the evidence for quintile 1 is much weaker.

In sum, we find substantial persistence in hedge fund short selling profitability for short short-horizon trades (trade length less than or equal to five days). This trade category, hedge fund short-horizon short sales, is one for which there was evidence of profitability in Table 3; the persistence results are consistent with this profitability being due to skill. We find some, but weaker, evidence of non-hedge fund profitability for longer-horizon trades in Panel D. This is the other category of trades for which there was some evidence of profitability in Table 3, although the estimates of abnormal performance were significant only for trade lengths between 21 and 63 days and were not large. Regardless, the evidence about persistence in Table 9 Panel D, while not strong, is consistent with the profitability in this category of trades being due to skill.

Table 10 presents the persistence results for long side performance of hedge funds and non-hedge fund investors. Unlike the results for short selling, we find evidence of both hedge

funds and non-hedges having skills with regards to long-side transactions. While evidence of persistence exist for both short horizon (trade length less than or equal to five days) and longer horizon (trade length greater than five days), the strongest level of persistence exists for hedge funds in the short horizon. Hedge funds appear to have skills in both short side and long side trades at short time horizons (trade length less than or equal to five days).

5. Conclusion

We combine data on transactions and holdings of institutional investors do identify the short sells, short buys, long sells, and long buys of hedge fund managers and other non-hedge fund institutional investors. The main idea of the approach to identify the trades is to use the fact that if an institutional investor whose transactions are in the ANcerno data ever reports a holding of a stock in a 13F filing, then we know the investor's position on one date and we can use the ANcerno transactions to construct the investor's position in the stock on all other dates. Knowledge of the investor's position in a stock on each date allows us to determine whether a sell trade is opening or increasing a short position or closing a long position and whether a buy trade is opening or increasing a long position or closing a short position. One piece of evidence that the approach successfully identifies short sales by hedge funds is the fact that it captures the 2008 short sale ban.

We obtain novel empirical results using these data. First, we find that hedge funds, compared with other institutional investors, tend to make profits from short-horizon trades that are covered within one week. Second, we document that hedge fund short sales have predictive power for future earnings announcements. Third, hedge funds engage in profitable short selling as liquidity providers. Fourth, hedge fund short positions exhibit persistent performance. In sum, we provide the first evidence in the literature that hedge funds are skilled short sellers.

References

- Ackermann, C., R. McEnally, and D. Ravenscraft, 1999, The performance of hedge funds: Risk, return, and incentives, *Journal of Finance* 54, 833-874.
- Agarwal, V., and N. Y. Naik, 2004, Risks and Portfolio Decisions Involving Hedge Funds, *Review of Financial Studies*, 17, 63–98.
- Agarwal, V., N. D. Daniel, and N. Y. Naik, 2007, Why is Santa so Kind to Hedge Funds? The December Return Puzzle! Working Paper, Georgia State University.
- Agarwal, V., N. M. Boyson, and N. Y. Naik, 2009, Hedge Funds for Retail Investors? An Examination of Hedged Mutual Funds. *Journal of Financial and Quantitative Analysis*, 44, pp 273-305.
- Agarwal, V., W. Jiang, Y. Tang, and B. Yang, 2013, Uncovering hedge fund skill from the portfolio holdings they hide, *Journal of Finance* 68, 739-783.
- Agarwal, V., G. D. Gay, and L. Ling, 2014, Window Dressing in Mutual Funds, *Review of Financial Studies* 27, 3133-3170.
- Akbas, F., E. Boehmer, B. Erturk, and S. Sorescu, 2013, Short interest, returns, and fundamentals, Unpublished working paper, University of Kansas.
- Amihud, Y., 2002, Illiquidity and stock returns: Cross-section and time-series effects, *Journal of Financial Markets* 5, 31-56.
- Anand, A., P. Irvine, A. Puckett, and K. Venkataraman, 2012, Performance of institutional trading desks: An analysis of persistence in trading costs, *Review of Financial Studies*, 25, 557-598.
- Aragon, G. and P. Strahan, 2012, Hedge funds as liquidity providers: Evidence from the Lehman bankruptcy, *Journal of Financial Economics* 103, 570-587.
- Asness, C., R. Krail, and J. Liew, 2001, Do Hedge Funds Hedge?: Be Cautious in Analyzing Monthly Returns, *Journal of Portfolio Management*, 28, 6–19.
- Asquith, P., and L. Meulbroek, 1996, An empirical investigation of short interest, Working paper, Harvard University
- Asquith, P., P. A. Pathak, and J. R. Ritter, 2005, Short interest, institutional ownership, and stock returns, *Journal of Financial Economics*, 78, 243–276.
- Bethel, J., G. Hu, and Q. Wang, 2009, The market for shareholder-voting rights around mergers and acquisitions: evidence from institutional daily trading and voting. *Journal of Corporate Finance*, 15, 129-145.

- Boehme, R. D., B. R. Danielsen, S. M. Sorescu, 2006, Short sale constraints, differences of opinion, and overvaluation, *Journal of Financial and Quantitative Analysis*, 41, 455–487.
- Boehmer, E., C. M. Jones, and X. Zhang, 2008, Which shorts are informed? *Journal of Finance* 63, 491–527.
- Boehmer, E., C. M. Jones, and X. Zhang, 2013, Shackling Short Sellers: The 2008 Shorting Ban *Review of Financial Studies* 26, 1363–1400.
- Brunnermeier M. K. and L. Pedersen, 2009, Market liquidity and funding liquidity, *Review of Financial Studies* 22, 2201–2238.
- Brunnermeier, M. K. and S. Nagel, 2004, Hedge Funds and the Technology Bubble, *Journal of Finance*, 59, 2013–2040.
- Campbell, J., S. Grossman, and J. Wang, 1993, Trading volume and serial correlation in stock returns, *Quarterly Journal of Economics* 108, 905–939.
- Carhart, M., 1997, On persistence in mutual fund performance, *Journal of Finance* 52, 57–82.
- Chemmanur, T. J., H. Shan, and G. Hu, 2009, The role of institutional investors in seasoned equity offerings, *Journal of Financial Economics*, 94, 384–411.
- Chen, H., N. Jegadeesh, and R. Wermers, 2000, The Value of Active Mutual Fund Management: An Examination of the Stockholdings and Trades of Fund Managers, *Journal of Financial and Quantitative Analysis*, 35, 343–368.
- Chen, Y., and B. Liang, 2007, Do Market Timing Hedge Funds Time the Market?, *Journal of Financial and Quantitative Analysis*, 42, 827–856.
- Cohen, L., K. B. Diether, and C. J. Malloy, 2007, Supply and demand shifts in the shorting market, *Journal of Finance* 62, 2061–2096.
- Cremers, K. J. Martijn, and A. Petajisto, 2009, How Active is Your Fund Manager? A New Measure that Predicts Performance, *Review of Financial Studies* 22, 3329–3365.
- Daniel, K., M. Grinblatt, S. Titman, and R. Wermers, 1997, Measuring mutual fund performance with characteristic-based benchmarks, *Journal of Finance* 52, 1035–1058.
- Danielsen, B. R. and S. M. Sorescu, 2001, Why do option introductions depress stock prices? *Journal of Financial and Quantitative Analysis* 36, 451–484.
- DellaVigna, S. D. and J. M. Pollet, 2009, Investor Inattention and Friday Earnings Announcements, *Journal of Finance* 64, 709–749.
- Desai, H. K. Ramesh, S. R. Thiagarajan, and B. V. Balachandran, 2002, An investigation of the informational role of short interest in the Nasdaq market, *Journal of Finance* 57, 2263–2287.

- Diamond, D. W., and R. E. Verrecchia, 1987, Constraints on short-selling and asset price adjustment to private information, *Journal of Financial Economics* 18, 277–311.
- Diether, K. B., C. J. Malloy, and A. Scherbina, 2002, Differences of opinion and the cross section of stock returns, *Journal of Finance* 57, 2113–2141.
- Diether, K. B., K. Lee, and I. M. Werner, 2009, Short-sale strategies and return predictability, *Review of Financial Studies* 22, 575–607.
- Dimson, E., 1979, Risk measurement when shares are subject to infrequent trading, *Journal of Financial Economics*, 7, 197–226.
- Engelberg, J. E., A. V. Reed, and M. C. Ringgenberg, 2012, How are shorts informed? Short sellers, news, and information processing, *Journal of Financial Economics* 105, 260–278.
- Fama, E. F., and J. D. MacBeth, 1973, Risk, return, and equilibrium: empirical tests. *Journal of Political Economy* 81, 607–36.
- Fama, E. F., and K. R. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3–56.
- Fama, E. F., and K. R. French, 2006, The Value Premium and the CAPM. *Journal of Finance*, 61: 2163–2185.
- Fung, W., and D. A. Hsieh, 1997, Empirical Characteristics of Dynamic Trading Strategies: The Case of Hedge Funds, *Review of Financial Studies*, 10, 275–302.
- Fung, W., and D. A. Hsieh, 2000, Performance Characteristics of Hedge Funds and Commodity Funds: Natural vs. Spurious Biases, *Journal of Financial and Quantitative Analysis*, 35, 291–307.
- Fung, W., and D. A. Hsieh, 2001, The Risk in Hedge Fund Strategies: Theory and Evidence from Trend Followers, *Review of Financial Studies*, 14, 313–341.
- Fung, W., and D. A. Hsieh, 2006, Hedge Funds: An Industry in Its Adolescence, *Economic Review*, 91, 1–34.
- Fung, W., D. A. Hsieh, N. Y. Naik, and T. Ramadorai, 2008, Hedge Funds: Performance, Risk, and Capital Formation, *Journal of Finance*, 63, 1777–1803.
- Green, C. T. and R. Jame, 2011, Strategic trading by index funds and liquidity provision around S&P 500 index additions, *Journal of Financial Economics*, 14, 605–624.
- Green, C. T., R. Jame, S. Markov, and M. Subasi, 2014, Broker-hosted investor conferences, *Journal of Accounting and Economics*, 58, 142–166.

- Goldstein, M., P. Irvine, E. Kandel, and Z. Wiener, 2009, Brokerage commissions and institutional trading patterns, *Review of Financial Studies*, 22, 5175–5212
- Griffin, J. and J. Xu, 2009, How smart are the smart guys? A unique view from hedge fund stock holdings, *Review of Financial Studies*, 22, 2531-2570.
- Hu, G., 2009, Measures of implicit trading costs and buy–sell asymmetry, *Journal of Financial Markets*, 12, 418-437
- Hu, G., R. D. McLean, J. Pontiff, and Q. Wang, 2014, The year-end trading activities of institutional investors: Evidence from daily trades, *Review of Financial Studies*, 27, 1593–1614.
- Jank, S. and Smajlbegovic, E., 2015, Dissecting Short-Sale Performance: Evidence from Large Position Disclosures, *Working paper*
- Jame, R., 2015, Liquidity Provision and the Cross-Section of Hedge Fund Returns, Working Paper
- Jegadeesh, N., and S. Titman, 1993, Returns to buying winners and selling losers: implications for stock market efficiency, *Journal of Finance* 48, 65–91.
- Kelley, E. K. and P. C. Tetlock, 2013b, Retail Short Selling and Stock Prices, Working Paper.
- Kosowski, R., A. Timmermann, R. Wermers, and H. White, 2006, Can mutual fund "stars" really pick stocks? New evidence from a bootstrap analysis, *Journal of Finance* 61, 2551-2595.
- Puckett, A. and X. S. Yan, 2011, The interim trading skill of institutional investors, *Journal of Finance* 66, 601-633.
- Rendleman, R., C. Jones and H. Latane', 1982, Empirical Anomalies Based On Unexpected Earnings and the Importance of Risk Adjustments, *Journal of Financial Economics* 10, 269-287.
- Rinne, K. and M. Suominen, 2010, Short-term reversals, returns to liquidity provision and the costs of immediacy, Working paper.
- Sadka, R., 2010, Liquidity risk and the cross-section of hedge-fund returns, *Journal of Financial Economics* 98, 54-71.
- Wermers, R., 2004, Is money really 'smart'? New evidence on the relation between mutual fund flows, manager behavior, and performance persistence, Working paper.

Table 1. Summary Statistics

Panel A provides the summary statistics of the data set for both the hedge fund and non-hedge fund sample. We report the total numbers of daily level short sales and long buys and average daily dollar amounts for each transaction type. In panel B, we report the number of managers and average number of stocks in long and short positions, separately, for each sample year. The sample period covers from Jan 1999 to Sep 2011.

Panel A			
	Hedge Fund	Non-Hedge Fund	Total
Total # of Managers	53	141	194
Total # of Traded Stocks	7,845	7,928	8,590
Total # of Short Sell	168,813	378,854	547,667
Total # of Short Buy	137,270	324,295	461,565
Total # of Long Buy	1,145,713	3,599,186	4,744,899
Total # of Long Sell	1,164,148	3,542,863	4,707,011
Average Dollar Amount of Daily Short Sell (in thousands)	743.34	748.49	746.90
Average Dollar Amount of Daily Short Buys (in thousands)	837.83	809.03	817.59
Average Dollar Amount of Daily Long Buys (in thousands)	695.11	1,261.74	1,124.92
Average Dollar Amount of Daily Long Sell (in thousands)	708.27	1,319.95	1,168.66

Panel B

Year	Total # of Manager		Average Number of Stocks in Long Position		Average Number of Stocks in Short Position	
	Hedge Fund	Non-Hedge Fund	Hedge Fund	Non-Hedge Fund	Hedge Fund	Non-Hedge Fund
1999	32	92	2,847	3,544	1,374	1,197
2000	33	97	3,038	3,441	1,194	1,785
2001	32	99	2,598	3,080	1,171	1,409
2002	34	105	2,529	2,976	801	1,585
2003	31	103	2,580	2,910	814	1,688
2004	33	105	2,790	3,105	1,054	1,805
2005	35	98	2,802	3,277	1,326	1,879
2006	39	97	2,630	3,337	1,375	1,965
2007	38	94	2,711	3,371	1,275	2,161
2008	39	98	2,657	3,134	1,567	2,063
2009	40	93	2,454	2,891	1,302	1,956
2010	41	92	2,419	2,933	1,418	2,043

Table 2. Trade Length

Panels A and B report summary statistics for short and long side trade length (*TL*), respectively, in trading days for both hedge funds (*HF*) and non-hedge funds (*NHF*). The table reports means, standard deviations, and 5, 25, 50, 75, and 95 percentiles. The third row, *HF-NHF*, denotes the difference between hedge fund and non-hedge fund trade length. *t*-statistics are in parentheses below the estimates of the differences between hedge fund and non-hedge fund investor trade length. *, **, and *** indicate statistical significance at 10, 5, and 1% levels, respectively.

Panel A: Short Side Trade Length								
	Mean	Std. dev.	5%	25%	50%	75%	95%	No. obs.
HF	50.80	59.88	1	7	25	72	192	101,281
NHF	53.64	58.77	2	10	29	78	188	274,581
HF – NHF	–2.84***							
	(–13.08)							
Panel B: Long Side Trade Length								
	Mean	Std. dev.	5%	25%	50%	75%	95%	No. obs.
HF	58.43	65.22	1	7	31	91	205	1,445,764
NHF	56.33	63.70	1	7	29	87	199	4,914,508
HF – NHF	2.09***							
	(34.54)							

Table 3. Profitability of Hedge Fund Short Trades

Panel A provides benchmark-adjusted (DGTW) daily returns on short side portfolios sorted on trade length (TL) for hedge funds (HF) and non-hedge (NHF) funds. The DGTW adjustment is based on Daniel, Grinblatt, Titman and Wermers (1997). We form five value-weighted TL portfolios ($TL \leq 5$, $5 < TL \leq 21$, $21 < TL \leq 63$, and $63 < TL \leq 252$) by including stocks in each portfolio from the opening until the closing of trades. Panel B reports the Carhart four factor model (Carhart, 1997) estimation results of the TL portfolio returns. We also report alpha estimates from Dimson's (1979) sum beta approach. Panels C and D report DGTW abnormal returns and the four-factor regression results, respectively, similar to Panels A and B. All the numbers in the parenthesis are t-statistics. *, **, and *** denote statistical significance at 10, 5, and 1% levels, respectively.

Panel A: Abnormal returns from DGTW adjustment for short trades								
	TL ≤ 5		5 < TL ≤ 21		21 < TL ≤ 63		63 < TL ≤ 252	
	HF	NHF	HF	NHF	HF	NHF	HF	NHF
Returns	-0.141%** (-2.36)	0.108%** (2.44)	-0.003% (-0.12)	-0.015% (-0.79)	-0.002% (-0.15)	-0.026%** (-2.24)	-0.004% (-0.35)	-0.005% (-0.60)
Panel B: Alpha estimation from the four factor model of Carhart (1997) for short trades								
	TL ≤ 5		5 < TL ≤ 21		21 < TL ≤ 63		63 < TL ≤ 252	
	HF	NHF	HF	NHF	HF	NHF	HF	NHF
α	-0.142%** (-2.29)	0.131%*** (2.79)	0.002% (0.08)	-0.018% (-0.88)	0.004% (0.28)	-0.029%** (-2.17)	-0.002% (-0.21)	-0.007% (-0.75)
β_{MKT}	1.190*** (24.85)	1.291*** (35.24)	1.127*** (49.79)	1.262*** (78.60)	1.120*** (93.44)	1.130*** (109.92)	1.131*** (125.16)	1.106*** (152.57)
β_{HML}	0.016 (0.17)	-0.456*** (-6.50)	-0.198*** (-4.56)	-0.330*** (-10.68)	0.080*** (3.47)	-0.154*** (-7.80)	0.004 (0.25)	-0.119*** (-8.59)
β_{SMB}	0.719*** (7.23)	0.632*** (8.44)	0.532*** (11.47)	0.584*** (17.75)	0.549*** (22.36)	0.478*** (22.72)	0.473*** (25.54)	0.451*** (30.42)
β_{UMD}	-0.356*** (-5.82)	-0.416*** (-8.89)	-0.242*** (-8.36)	-0.242*** (-11.75)	-0.204*** (-13.31)	-0.175*** (-13.31)	-0.191*** (-16.51)	-0.127*** (-13.67)
R ²	0.2365	0.3724	0.5177	0.7276	0.7852	0.8332	0.8655	0.9035
N. Obs.	2,931	3,188	3,207	3,207	3,207	3,207	3,207	3,207
Dimson α	-0.132%** (-2.13)	0.126%*** (2.68)	0.002% (0.08)	-0.021% (-1.04)	0.005% (0.31)	-0.029%** (-2.24)	-0.002% (-0.13)	-0.005% (-0.54)

Table 4. Profitability of Hedge Fund Long Trades

Panel A provides benchmark-adjusted (DGTW) daily returns on short side portfolios sorted on trade length (TL) for hedge funds (HF) and non-hedge (NHF) funds. The DGTW adjustment is based on Daniel, Grinblatt, Titman and Wermers (1997). We form five value-weighted TL portfolios ($TL \leq 5$, $5 < TL \leq 21$, $21 < TL \leq 63$, and $63 < TL \leq 252$) by including stocks in each portfolio from the opening until the closing of trades. Panel B reports the the Carhart four factor model (Carhart, 1997) estimation results of the TL portfolio returns. We also report alpha estimates from Dimson's (1979) sum beta approach. Panels C and D report DGTW abnormal returns and the four-factor regression results, respectively, similar to Panels A and B. All the numbers in the parenthesis are t-statistics. *, **, and *** denote statistical significance at 10, 5, and 1% levels, respectively.

Panel A: Abnormal returns from DGTW adjustment for long trades								
	TL \leq 5		5<TL \leq 21		21<TL \leq 63		63<TL \leq 252	
	HF	NHF	HF	NHF	HF	NHF	HF	NHF
Returns	0.031%	-0.193%***	-0.012%	-0.047%***	-0.019%***	-0.026%***	0.004%	-0.001%
	(0.98)	(-13.86)	(-1.00)	(-6.25)	(-2.77)	(-5.44)	(0.86)	(-0.22)
Panel B: Alpha estimation from the four factor model of Carhart (1997) for long trades								
	TL \leq 5		5<TL \leq 21		21<TL \leq 63		63<TL \leq 252	
	HF	NHF	HF	NHF	HF	NHF	HF	NHF
α	0.036%	-0.226%***	-0.007%	-0.056%***	-0.022%***	-0.030%***	0.001%	-0.003%
	(1.05)	(-14.07)	(-0.51)	(-6.53)	(-2.82)	(-5.68)	(0.11)	(-0.80)
β_{MKT}	1.120***	1.157***	1.159***	1.148***	1.132***	1.124***	1.055***	1.091***
	(42.14)	(92.38)	(104.24)	(172.91)	(188.04)	(269.68)	(292.13)	(375.65)
β_{HML}	-0.133***	-0.143***	-0.107***	-0.210***	0.013	-0.114***	0.122***	0.007
	(-2.61)	(-5.96)	(-4.99)	(-16.43)	(1.083)	(-14.30)	(17.52)	(1.26)
β_{SMB}	0.303***	0.154***	0.313***	0.201***	0.272***	0.210***	0.228***	0.197***
	(5.57)	(6.01)	(13.75)	(14.76)	(22.04)	(24.59)	(30.81)	(33.08)
β_{UMD}	0.003	-0.103***	-0.114***	-0.097***	-0.075***	-0.056***	-0.036***	0.013***
	(0.10)	(-6.40)	(-7.98)	(-11.44)	(-9.77)	(-10.59)	(-7.89)	(3.49)
R^2	0.3972	0.7652	0.8085	0.9202	0.9302	0.9647	0.9691	0.9807
N. Obs.	3,207	3,207	3,207	3,207	3,207	3,207	3,207	3,207
Dimson α	0.036%	-0.224%***	-0.007%	-0.055%***	-0.022%***	-0.031%***	0.001%	-0.003%
	(1.06)	(-13.96)	(-0.48)	(-6.54)	(-2.89)	(-5.84)	(0.16)	(-0.84)

Table 5. Prediction of Earnings Surprises

This table reports the regression of future earnings surprise on short sell intensities of hedge funds and non-hedge funds. The dependent variable is an earnings surprise calculated following DellaVigna and Pollet (2009). The explanatory variables are short sell, short buy, long buy, and long sell intensities (*SSI*, *SBI*, *LBI*, and *LSI*, respectively), a dummy variable indicating negative earnings (*NEGE*), dummy variables indicating positive (*ACC-*) and negative accruals per share (*ACC+*), a percent change in total asset (*AG*), a dummy variable indicating zero dividends (*DD*), dividends per share (*DPS*), and log book-to-market ($\ln(BE/ME)$). *SSI* and *LBI* are calculated as ratios of dollar amounts of short sells and long buys to dollar amount of total trades, respectively. Columns *Window 1* use explanatory variables known in the past week and Columns *Window 2* use explanatory variables in the past one week to one month. The numbers in parentheses are time clustered t-statistics. *, **, and *** denote statistical significance at 10, 5, and 1% levels.

	Short Sell Intensity			
	Hedge Fund		Non-Hedge Fund	
	Window 1 (t-1 ~ t-5)	Window 2 (t-6 ~ t-21)	Window 1 (t-1 ~ t-5)	Window 2 (t-6 ~ t-21)
<i>SSI</i>	-0.163* (-1.83)	-0.045 (-0.75)	-0.149* (-1.7)	-0.161* (-1.76)
<i>SBI</i>	-0.066 (-0.43)	-0.066 (-0.97)	-0.161 (-1.6)	-0.404*** (-2.69)
<i>LBI</i>	-0.026 (-0.76)	-0.038 (-0.98)	0.002 (0.05)	0.071* (1.66)
<i>LSI</i>	-0.014 (-0.39)	-0.003 (-0.07)	-0.022 (-0.61)	-0.032 (-0.67)
<i>NEGE</i>	-0.267* (-1.95)	-0.425*** (-3.46)	-0.440*** (-3.62)	-0.507*** (-4.31)
<i>ACC+</i>	0.152*** (3.17)	0.191*** (4.55)	0.176*** (3.84)	0.186*** (4.6)
<i>ACC-</i>	0.146*** (2.81)	0.197*** (4.52)	0.187*** (4.11)	0.207*** (5.01)
<i>AG</i>	-0.033 (-1.18)	-0.007 (-0.32)	-0.010 (-0.4)	-0.015 (-0.84)
<i>DD</i>	-0.002 (-0.08)	-0.024 (-0.98)	0.005 (0.19)	-0.016 (-0.66)
<i>DPS</i>	-0.011 (-0.64)	-0.001 (-0.07)	0.007 (0.58)	0.005 (0.47)
$\ln(BE/ME)$	-0.074*** (-2.97)	-0.067*** (-3.56)	-0.081*** (-3.79)	-0.089*** (-4.36)
Adj. R ²	0.549%	0.737%	0.791%	1.030%
Num. Obs.	1,691	1,794	1,791	1,844
Intercept	Yes	Yes	Yes	Yes

Table 6. Short Sell Profitability from Earnings Announcements

This table provides benchmark-adjusted daily returns on short side portfolios sorted on days to cover (TL) and earnings announcement for hedge funds (HF) and non-hedge (NHF) funds. The benchmark adjustment is based on Daniel, Grinblatt, Titman and Wermers (1997). We first sort stocks into two TL buckets based on days to cover ($TL \leq 5$ and $5 < TL \leq 21$). Within each bucket we form earnings announcement (EA) and non-earnings announcement (Non-EA) portfolios. If there is an earnings announcement of the stock within its days to cover, we include the stock in the EA portfolio. Otherwise, we include the stock in the Non-EA portfolio. We calculate value-weighted returns on the portfolios from the opening until the closing of trades. The column Diff. reports the return difference between the EA and Non-EA portfolios. The numbers in the parenthesis are t-statistics. *, **, and *** denote statistical significance at 10, 5, and 1% levels.

	TL \leq 5						5<TL \leq 21					
	Hedge Fund			Non-Hedge Fund			Hedge Fund			Non-Hedge Fund		
	EA	Non-EA	Diff.	EA	Non-EA	Diff.	EA	Non-EA	Diff.	EA	Non-EA	Diff.
Returns	-0.158%	-0.127%**	-0.031%	0.052%	0.118%***	-0.066%	0.007%	-0.009%	0.016%	0.023%	-0.017%	0.040%
	(-0.704)	(-2.1)	(-0.135)	(0.352)	(2.631)	(-0.425)	(0.116)	(-0.309)	(0.244)	(0.56)	(-0.84)	(0.908)
N. Obs.	293	20,438		634	42,231		1,614	24,435		4,920	67,485	

Table 7. Short Sell Profitability (TL≤5) for Positive vs. Negative Opening Day Returns

Panel A provides benchmark-adjusted (DGTW) daily returns on short side portfolios for hedge funds (HF) and non-hedge (NHF) funds. The DGTW adjustment is based on Daniel, Grinblatt, Titman and Wermers (1997). We sort stocks with days to cover less than or equal to five days into two value-weighted portfolios of positive opening day return ($R_t > 0$) and negative opening day return ($R_t \leq 0$). We include stock in each portfolio from the opening until the closing of trades. Panel B reports the Carhart four factor model (Carhart, 1997) estimation results of two portfolio returns. All the numbers in the parenthesis are t-statistics. *, **, and *** denote statistical significance at 10, 5, and 1% levels, respectively.

Panel A: Portfolio Profitability of Trades with TL≤5 from Short Run Reversal

	Hedge Fund			Non-Hedge Fund		
	$R_t > 0$	$R_t \leq 0$	Diff.	$R_t > 0$	$R_t \leq 0$	Diff.
Returns	-0.242%*** (-3.33)	0.070% (1)	-0.312%*** (-3.09)	0.096%** (1.96)	0.087% (1.64)	0.009% (0.12)
Nobs.	9,703	11,029		19,599	23,265	

Panel B: Four Factor Model Results for Portfolio Return of Trades with TL≤5 from Short Run Reversal

	Hedge Fund			Non-Hedge Fund		
	$R_t > 0$	$R_t \leq 0$	Diff.	$R_t > 0$	$R_t \leq 0$	Diff.
α	-0.232%*** (-3.05)	0.071% (0.97)	-0.302%*** (-2.93)	0.113%** (2.17)	0.094%* (1.67)	0.019% (0.27)
β_{MKT}	1.181*** (11.36)	1.206*** (16.55)	-0.025 (-0.19)	1.271*** (28.17)	1.357*** (19.11)	-0.085 (-1.1)
β_{HML}	0.113 (0.59)	-0.351** (-2.16)	0.464* (1.88)	-0.328*** (-2.98)	-0.490*** (-3.86)	0.163 (1.06)
β_{SMB}	0.762*** (4.07)	0.737*** (4.49)	0.025 (0.1)	0.710*** (7.18)	0.575*** (4.95)	0.135 (0.96)
β_{UMD}	-0.223*** (-2.67)	-0.404*** (-3.84)	0.181 (1.38)	-0.302*** (-4.34)	-0.351*** (-4.64)	0.049 (0.52)
Adj. R^2	0.1870	0.2141		0.3163	0.3081	
N. Obs.	2,567	2,631		3,131	3,152	

Table 8. Short Sell Profitability (TL≤5) for Positive vs. Negative Closing Day Returns

Panel A provides benchmark-adjusted (DGTW) daily returns on short side portfolios for hedge funds (HF) and non-hedge (NHF) funds. The DGTW adjustment is based on Daniel, Grinblatt, Titman and Wermers (1997). We sort stocks with days to cover less than or equal to five days into four value-weighted portfolios: positive opening day and positive closing day returns ($R_t > 0$ and $R_{t+k} > 0$), positive opening day and negative closing day returns ($R_t > 0$ and $R_{t+k} \leq 0$), negative opening day and positive closing day returns ($R_t \leq 0$ and $R_{t+k} > 0$), and negative opening day and negative closing day returns ($R_t \leq 0$ and $R_{t+k} \leq 0$). We include stock in each portfolio from the opening until the closing of trades. All the numbers in the parenthesis are t-statistics. *, **, and *** denote statistical significance at 10, 5, and 1% levels, respectively.

Portfolio Profitability of Trades with TL≤5 from Short Run Reversal								
	Hedge Fund				Non-Hedge Fund			
	$R_t > 0$		$R_t \leq 0$		$R_t > 0$		$R_t \leq 0$	
	$R_{t+k} > 0$	$R_{t+k} \leq 0$	$R_{t+k} > 0$	$R_{t+k} \leq 0$	$R_{t+k} > 0$	$R_{t+k} \leq 0$	$R_{t+k} > 0$	$R_{t+k} \leq 0$
Returns	0.877%*** (10.98)	-1.299%*** (-15.07)	1.023%*** (12.35)	-1.033%*** (-14.96)	1.006%*** (18.85)	-0.996%*** (-18.6)	1.027%*** (17.27)	-1.151%*** (-17.57)
Nobs.	4,794	4,909	5,691	5,338	10,090	9,509	12,397	10,868

Table 9. Persistence of Short Side Profitability

This table reports benchmark-adjusted daily returns on hedge fund short portfolios sorted on the past profitability of short positions. Return adjustment follows Daniel, Grinblatt, Titman and Wermers (1997). In Panel A, we sort hedge fund managers at the end of each quarter ($t = 0$) into quintile portfolios based on the quarter's return on their short positions with days to close less than or equal to five. For the following four quarters (Q1 through Q4), we report equal-weighted averages of managers' value-weighted short portfolios with days to close less than or equal to five. We include stocks in the portfolios during actual opening and closing. The last row (*Low-High*) of the panel shows returns from the zero-cost portfolio that longs the lowest quintile portfolio and shorts the highest quintile portfolio. Panel B reports results for non-hedge fund managers. Panels C and D report results based on short positions with days to close greater than five for hedge funds and non-hedge funds, respectively. The numbers in parentheses are t-statistics. *, **, and *** denote statistical significance at 10, 5, and 1% levels, respectively.

Panel A: Persistence of Hedge Fund Short Position Profitability (TL≤5)					
	t = 0	Q1	Q2	Q3	Q4
1 (Low)	-1.493%*** (-5.13)	-0.422% (-1.5)	-0.234% (-0.79)	-0.292% (-1.63)	-0.745%*** (-3.75)
2	-0.597%*** (-6.83)	-0.208% (-1.36)	-0.141% (-0.73)	-0.280% (-1.34)	-0.016% (-0.1)
3	-0.168%** (-2.08)	-0.176% (-1.36)	-0.397%*** (-2.89)	-0.195% (-1.57)	-0.135% (-1.05)
4	0.398%*** (3.69)	0.057% (0.46)	0.248%** (2.07)	0.107% (0.77)	0.179% (1.21)
5 (High)	1.092%*** (9.33)	0.307%** (2.12)	0.190%* (1.83)	0.224% (1.51)	0.223% (1.18)
Low - High	-2.585%*** (-8.66)	-0.729%** (-2.19)	-0.424% (-1.4)	-0.516%** (-2.21)	-0.968%*** (-3.39)

Panel B: Persistence of Non-Hedge Fund Short Position Profitability (TL≤5)					
	t = 0	Q1	Q2	Q3	Q4
1 (Low)	-1.227%*** (-8.41)	-0.006% (-0.06)	0.092% (0.84)	-0.165% (-1.23)	0.004% (0.02)
2	-0.411%*** (-10.62)	-0.020% (-0.27)	0.032% (0.37)	0.072% (0.93)	-0.042% (-0.43)
3	-0.013% (-0.37)	-0.006% (-0.06)	0.032% (0.29)	-0.034% (-0.51)	-0.087% (-1.42)
4	0.423%*** (9.7)	0.100% (1.09)	0.044% (0.63)	0.100% (1.55)	0.106% (1.03)
5 (High)	1.214%*** (9.01)	0.129% (1.19)	-0.047% (-0.37)	0.221%* (1.98)	0.143%* (1.71)
Low - High	-2.441%*** (-11.43)	-0.135% (-0.87)	0.139% (0.82)	-0.386%** (-2.41)	-0.139% (-0.78)

Panel C: Persistence of Hedge Fund Short Position Profitability (TL>5)

	t = 0	Q1	Q2	Q3	Q4
1 (Low)	-0.330%*** (-8.9)	-0.040% (-1.03)	-0.031% (-1.1)	-0.034% (-1.15)	-0.018% (-0.45)
2	-0.128%*** (-9.33)	-0.041%** (-2.11)	-0.040%** (-2.08)	-0.026% (-1.24)	-0.023% (-1.07)
3	-0.009% (-0.97)	-0.019% (-1.26)	-0.021% (-1.31)	-0.041%** (-2.25)	-0.015% (-1.09)
4	0.085%*** (7.51)	-0.004% (-0.24)	-0.015% (-1.07)	-0.006% (-0.37)	-0.000% (-0.02)
5 (High)	0.394%*** (5.13)	-0.001% (-0.03)	-0.050% (-1.12)	0.023% (0.62)	0.050% (1.25)
Low - High	-0.723%*** (-7.62)	-0.039% (-0.75)	0.019% (0.35)	-0.057% (-1.11)	-0.068% (-1.15)

Panel D: Persistence of Non-Hedge Fund Short Position Profitability (TL>5)

	t = 0	Q1	Q2	Q3	Q4
1 (Low)	-0.361%*** (-12.73)	0.032% (1.57)	0.010% (0.52)	-0.032%* (-1.75)	-0.070%* (-1.76)
2	-0.087%*** (-11.63)	0.001% (0.12)	0.009% (0.71)	0.004% (0.28)	-0.019% (-1.32)
3	-0.001% (-0.11)	0.010% (0.91)	-0.001% (-0.09)	-0.005% (-0.36)	0.010% (0.59)
4	0.105%*** (9.46)	0.002% (0.24)	0.014% (0.96)	0.004% (0.39)	0.009% (0.65)
5 (High)	0.373%*** (10.89)	0.043%** (2.2)	0.042%** (2.17)	0.048%*** (2.72)	0.058%* (1.9)
Low - High	-0.735%*** (-14.23)	-0.012% (-0.39)	-0.032% (-1.07)	-0.079%*** (-3.21)	-0.128%** (-2.43)

Table 10. Persistence of Long Side Profitability

This table reports benchmark-adjusted daily returns on hedge fund long portfolios sorted on the past profitability of long positions. Return adjustment follows Daniel, Grinblatt, Titman and Wermers (1997). In Panel A, we sort hedge fund managers at the end of each quarter ($t=0$) into quintile portfolios based on the quarter's return on their long positions with days to close less than or equal to five. For the following four quarters (Q1 through Q4), we report equal-weighted averages of managers' value-weighted long portfolios with days to close less than or equal to five. We include stocks in the portfolios during actual opening and closing. The last row (*Low-High*) of the panel shows returns from the zero-cost portfolio that longs the lowest quintile portfolio and shorts the highest quintile portfolio. Panel B reports results for non-hedge fund managers. Panels C and D report results based on long positions with days to close greater than five for hedge funds and non-hedge funds, respectively. The numbers in parentheses are t -statistics. *, **, and *** denote statistical significance at 10, 5, and 1% levels, respectively.

Panel A: Persistence of Hedge Fund Long Position Profitability (TL≤5)					
	t = 0	Q1	Q2	Q3	Q4
1 (Low)	-1.930%*** (-9.78)	-0.773%*** (-6.4)	-0.710%*** (-6.24)	-0.621%*** (-6.88)	-0.647%*** (-5.77)
2	-0.488%*** (-8.43)	-0.412%*** (-3.75)	-0.341%*** (-3.35)	-0.283%*** (-3.76)	-0.205%*** (-2.97)
3	0.022% (0.93)	0.046% (0.54)	-0.002% (-0.03)	-0.008% (-0.1)	-0.101% (-1.47)
4	0.385%*** (11.56)	0.199% (1.43)	0.100% (1.17)	0.103% (1.45)	0.197%*** (2.93)
5 (High)	1.551%*** (9.17)	0.610%*** (5.13)	0.433%*** (3.8)	0.351%*** (3.54)	0.510%*** (5.67)
High - Low	3.480%*** (12.48)	1.383%*** (7.53)	1.143%*** (6.55)	0.972%*** (7.48)	1.158%*** (8.45)

Panel B: Persistence of Non-Hedge Fund Long Position Profitability (TL≤5)					
	t = 0	Q1	Q2	Q3	Q4
1 (Low)	-1.579%*** (-9.48)	-0.583%*** (-4.74)	-0.509%*** (-3.09)	-0.390%*** (-4.65)	-0.296%*** (-3.1)
2	-0.355%*** (-11.74)	-0.109%** (-2.65)	-0.224%*** (-4.58)	-0.131%*** (-2.73)	-0.148%*** (-3.03)
3	0.000% (0.01)	-0.070% (-1.44)	-0.084% (-1.05)	-0.034% (-0.63)	-0.071% (-1.37)
4	0.331%*** (7.93)	0.269%** (2.49)	0.214%*** (2.96)	0.176% (1.54)	0.036% (0.39)
5 (High)	1.577%*** (9.46)	0.258%* (1.78)	0.403%*** (2.78)	0.219% (1.56)	0.398%** (2.42)
High - Low	3.156%*** (12.1)	0.842%*** (4.07)	0.912%*** (4.42)	0.609%*** (3.7)	0.694%*** (3.56)

Panel C: Persistence of Hedge Fund Long Position Profitability (TL>5)

	t = 0	Q1	Q2	Q3	Q4
1 (Low)	-0.146%*** (-15.01)	-0.015% (-1.43)	-0.016% (-1.49)	-0.018%** (-2.1)	-0.014% (-1.05)
2	-0.042%*** (-9.06)	-0.003% (-0.72)	-0.010% (-1.17)	0.003% (0.51)	0.002% (0.22)
3	0.011%*** (2.86)	0.008% (1.15)	0.015%** (2.46)	0.012%** (2.05)	0.014%** (2.46)
4	0.070%*** (13.26)	0.049%*** (5.21)	0.044%*** (5.17)	0.028%*** (4.1)	0.023%*** (3.2)
5 (High)	0.227%*** (14.31)	0.070%*** (5.93)	0.061%*** (5.53)	0.069%*** (6.03)	0.046%*** (4.14)
High - Low	0.373%*** (23.51)	0.085%*** (5.29)	0.076%*** (4.23)	0.086%*** (7.57)	0.060%*** (3)

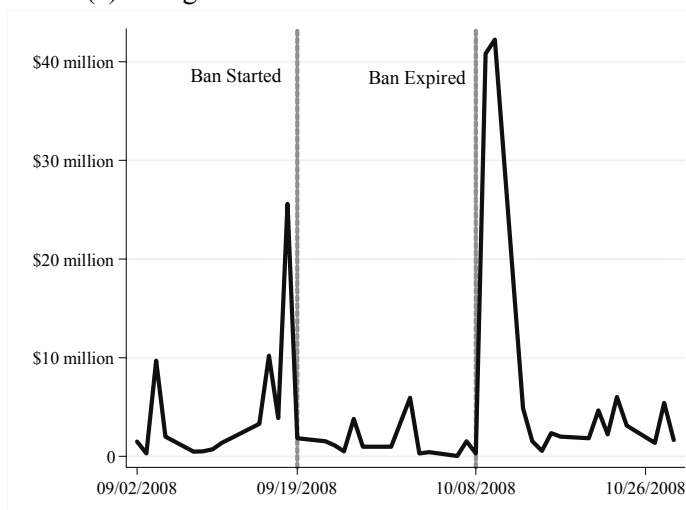
Panel D: Persistence of Non-Hedge Fund Long Position Profitability (TL>5)

	t = 0	Q1	Q2	Q3	Q4
1 (Low)	-0.163%*** (-13.78)	-0.014%* (-1.73)	-0.019%** (-2.39)	-0.009% (-1.25)	-0.009% (-0.98)
2	-0.047%*** (-11.08)	-0.009%* (-1.83)	-0.009%* (-1.7)	-0.007% (-1.4)	0.004% (0.37)
3	0.000% (0.11)	0.001% (0.16)	0.002% (0.45)	0.003% (0.7)	-0.001% (-0.24)
4	0.051%*** (9.95)	0.014%*** (2.79)	0.014%** (2.31)	0.011%* (1.99)	0.007% (1.1)
5 (High)	0.200%*** (16.22)	0.050%*** (6.82)	0.049%*** (6.5)	0.035%*** (5.31)	0.049%*** (5.42)
High - Low	0.363%*** (17.66)	0.065%*** (6.24)	0.068%*** (6.57)	0.044%*** (5.4)	0.058%*** (4.18)

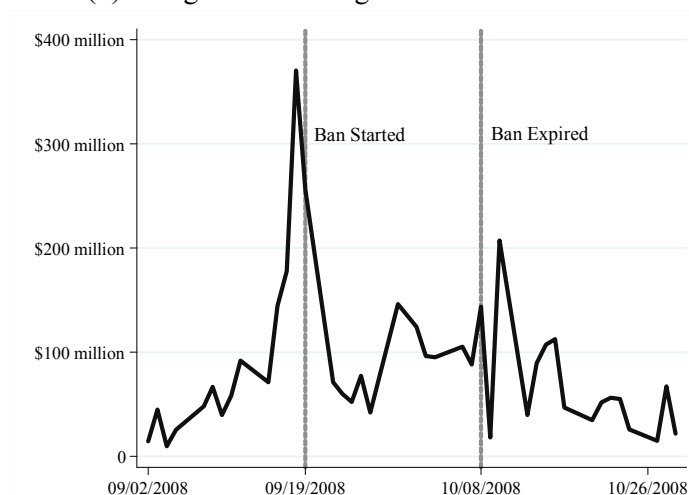
Figure 1. Short and Long Sales during the Short Sale Ban in September and October 2008

This figure plots (a) daily short sales and (b) long sales by hedge funds and (c) short sales and (d) long sales by all institutional investors during the period from September 15 2008 through October 15 2008. We only include financial stocks in the graphs. The two vertical dash lines in each graph denote the dates when the short sale ban was implemented (September 19) and repealed (October 8).

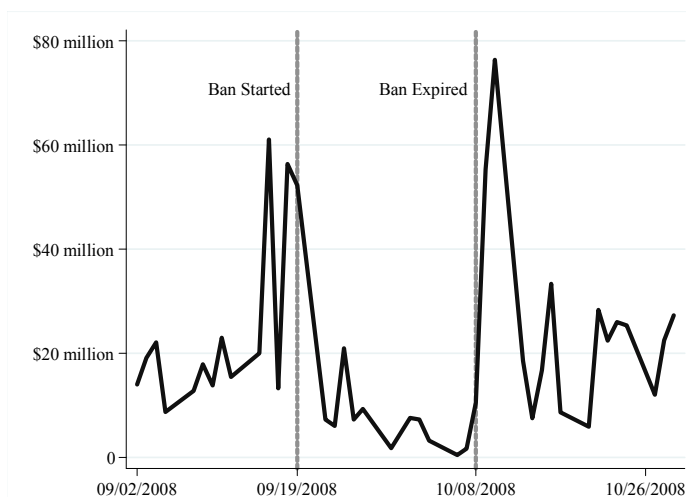
(a) Hedge Fund's Short Sales of Financial Stocks



(b) Hedge Fund's Long Sales of Financial Stocks



(c) All Institutional Investors' Short Sales of Financial Stocks



(d) All Institutional Investors' Long Sales of Financial Stocks

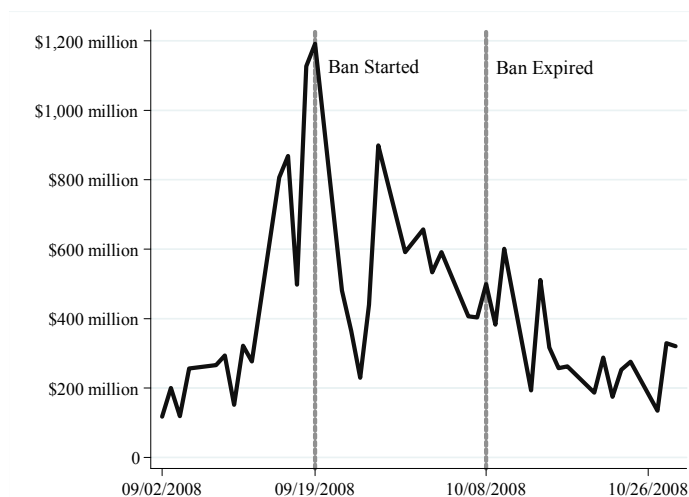


Figure 2. Hedge Fund Short and Long Sales during the Financial Crisis

This figure plots dollar amounts of short sales by hedge funds in our sample for the period from 2007 through June of 2009. The figure on the left plots (a) aggregate short sales and the figure on the right plots (b) aggregate long sales in billions of dollars. Straight lines in each graph represent trends in data.

