

Hedge Funds in M&A Deals: Is there Exploitation of Insider Information?*

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Abstract

This paper investigates trading patterns in target and acquirer firms prior to the public announcement of M&A deals. We analyze this issue by differentiating whether the trading is conducted by hedge funds with short-term investment horizons (henceforth, short-term hedge funds) or other institutional investors in both the equity and derivatives markets. We consider several alternative explanations for short-term hedge fund trading patterns prior to the public announcement of M&A deals, such as those related to a hedge fund's skill in identifying profitable trades' ex-ante; however our results seem inconsistent with these alternative explanations.

Keywords: Short-term hedge funds, information leakage, insider information, merger and acquisitions, short-selling, long target holdings.

JEL Classifications: D82, G30, G34

1. Introduction

Over the last couple of years there has been a marked increase in allegations and prosecutions regarding the misuse of insider (or material non-public) information in mergers and acquisitions (M&As) which has attracted the attention of regulatory authorities and researchers. While the generation of superior knowledge about a company from public, non-public, and non-material information is not illegal, the use of material insider information certainly is.

Over the last few years the *Wall Street Journal*, has reported several times that the SEC has been investigating potential insider information leakages prior to the public announcement of M&A deals. As part of their investigation, the SEC sent subpoenas to more than 30 hedge funds, some of which were related to trading in Schering-Plough Corp stock prior to its takeover by Merck & Co. in 2009, while others were related to MedImmune Inc.'s takeover by AstraZeneca PLC in 2007.¹ Additionally, in two other cases involving the Galleon and Jefferies hedge funds, the SEC arrested over a dozen people for leaking and trading on insider information prior to M&A deals.² Indeed, in May 2011, Raj Rajaratnam, founder of the \$7 billion Galleon hedge fund was found guilty of 14 counts of securities fraud, many related to M&A activity.³ However, so far, the question as to what extent hedge funds may be involved in such activities has not been established or examined systematically in the finance literature. The high turnover of their portfolios, their undiversified investment strategies, and the absence of reporting requirements makes hedge fund trading less conspicuous to market regulators; while the absence of regulatory

¹ See *Wall Street Journal*, November 20, 2010, “U.S. in Vast Insider Trading Probe”, by Pulliam, Rothfeld, Strasburg, and Zuckerman.

² According to the SEC, prosecutors brought a civil suit in New York (No. 09-cv-01043) of insider-trading against seven defendants, including Ramesh Chakrapani, an M&A managing director at Blackstone, and Joseph Contorinis, a portfolio manager, at Jefferies Group hedge fund. This case of unlawful insider trading from Nov. 2005 through Dec 2006 produced more than \$8 million in illegal profits. Details of this case are available at <http://www.sec.gov/litigation/complaints/2009/comp20884.pdf>.

³ See *Wall Street Journal*, May 12, 2011, “Fund Titan Found Guilty”, by Rothfeld, Pulliam, and Bray.

disclosures and intensive use of short selling and derivative trading strategies impede insightful investigation.⁴

It has been shown in the prior literature that trading on insider or material non-public information not only leads to considerable profits around mergers and acquisitions but also imposes externality costs such as higher target premiums or lower probability of deal completion.⁵ For example, in the weeks after a board meeting of First Federal Bancshares Inc. (FFBI), to consider offers from potential acquirers, its stock price jumped from \$18 to an 18-month high of \$24. First Federal's merger proxy statement claimed "[i]t was the board of directors' belief that the increase in the price of the stock most likely reflected speculation of a merger and not an actual increase in the intrinsic value of FFBI."⁶

In this paper, we analyze trading patterns in target and acquirer firms around M&A announcements. We analyze this issue by using an extensive hedge fund dataset which allows us to analyze the trading patterns of hedge funds around corporate M&As. Specifically, we investigate the extent to which hedge funds take long positions in a target's stock in the quarter prior to an M&A announcement, without having held any positions in that stock in the past 4 quarters. We define such hedge funds as short-term hedge funds. Additionally for the same deals, we examine the abnormal trading patterns in the short positions of the acquirer's stock prior to

⁴ Echoing similar sentiments, in his testimony before the Subcommittee on Securities, Insurance, and Investment of the U.S. Senate Committee on Banking, Housing, and Urban Affairs, on July 15, 2009, Andrew J. Donohue, Director of the Division of Investment Management, U.S. Securities and Exchange Commission, said ".....the securities laws have not kept pace with the growth and market significance of hedge funds and other private funds and, as a result, the Commission has very limited oversight authority over these vehicles. Sponsors of private funds – typically investment advisers – are able to organize their affairs in such a way as to avoid registration under the federal securities laws." Available at: <http://www.sec.gov/news/testimony/2009/ts071509ajd.htm>

⁵ According to a study of global M&A over 1994-2007 (Moeller and Omiros, 2009), only 49% of leaked deals are completed, whereas 72% of non-leaked deals are completed; leaked deals take 70% longer to complete than non-leaked deals.

⁶ Stephen Luparello, NASD's senior executive vice president for regulatory operations, say "[m]ore sophisticated players have more tools... [w]hen it comes to catching insider trading, it makes it harder and harder because they can be working in the options, they can be working in the equities, [and] they can be doing a swap over the counter."

the announcement. We also look into the abnormal trading activity in equity derivatives prior to these announcements.

We hypothesize that such sudden pre-announcement entry of a short-term hedge fund (as defined above) as a target shareholder is potentially less likely to be associated with special skills in identifying potential targets, as in such situations the hedge fund would have gradually built up a long position in the target firm. We however recognize that cleanly separating hedge fund managerial skills from opportunistic trading utilizing leaked insider information is extremely difficult. Accordingly, similar to other studies (see, for example, the backdating of the executive stock option literature, Heron and Lie, 2006), our results and analysis should be treated as merely suggestive at this point.

Our strategy of identifying short-term hedge funds is partly motivated by the conviction of Galleon hedge fund founder Raj Rajaratnam on multiple cases of securities fraud. For example, in one case it was alleged that, on March 20, 2008, Raj Rajaratnam was tipped on insider information about Clearwire, which eventually resulted in Galleon purchasing at least 500,000 shares of Clearwire through March 24 to 26. In fact, as indicated in its 13F filings, Galleon did not build any long position in Clearwire in the three quarter ends prior to March. According to March 13F filing in 2008, Galleon reported a position of 915,407 shares of Clearwire stock and 94,300 shares from Clearwire call options.⁷

⁷ While in general, it may be difficult to identify which hedge funds are more likely to acquire and use leaked insider information about M&A deals, anecdotal evidence suggests that short-term hedge funds may well obtain such information through private connections in the industry. In the recent insider-trading charges initiated by the FBI “[o]ne focus of the criminal investigation is examining whether nonpublic information was passed along by independent analysts and consultants who work for companies that provide "expert network" services to hedge funds...” Similarly, in the Galleon Tech fund and Hilton Case, the insider information came to Rajaratnam via a friend who had in turn obtained it from her cousin’s roommate who was working as an analyst at Moody’s rating agency while it was evaluating Hilton’s debt in connection with the upcoming takeover deal.

Many empirical papers suggest that short-term hedge fund holdings would be more likely to be associated with the leakage of insider information about M&A deals rather than shareholder activism, monitoring by hedge funds, or cherry-picking of investment strategies which have been shown to be associated with *long-term* holdings by hedge funds and other institutional investors. For example, Chen, Harford, and Li (2007) argue that institutional investors benefit from short-term trading only if they have superior information concerning firm specific events, while independent long-term institutions actively monitor and benefit from their effort. On the other hand, Bodnaruk, Massa, and Simonov (2009), suggest that financial advisors affiliated with investment banks are privy to insider information in takeovers by showing that their preannouncement stakes in targets are positively related to the probability of a successful bid and to the target's premium.^{8,9}

In fact, the analysis of preannouncement short-selling and derivative trading also suggests that such trading is less likely to be associated with hedge fund skills. This is because we are considering very rare events, i.e. announcement of M&A deals that are difficult to predict with great precision, given public information. Cao, Chen and Griffin (2005) explained this issue as follows: “Unlike pre-scheduled earnings announcements, takeover announcements are not

⁸ Lhabitan (2006) suggests that the relationship between investment bankers and hedge funds has also witnessed interesting developments in recent years. Providing prime brokerage service to hedge funds has been considered important business to investment banks who compete aggressively to obtain additional hedge funds as their clients. In addition, anecdotal evidence suggests that hedge funds and investment bankers maintain close relationship other than business. This supply-driven and personal relationship between hedge funds and investment bankers, makes one suspect whether material non-public information concerning M&A deals at investment banks are fire-walled properly from their hedge fund clients.

⁹ Our paper is also related to the risk arbitrage literature, in which investors take long positions in the target stock and may take short positions in the acquirer's stock in non-cash deals. See, for example, Mitchell and Pulvino (2001), Baker and Savasoglu (2002), and Hsieh and Walking (2005) who document that such strategies tend to generate substantial excess returns. The primary distinction between this form of merger arbitrage and trading based on material non-public information has to do with the timing of the long and short positions. In most merger arbitrages, the positions in the target and acquirer are entered into on the day of the public announcement, while in the case of informed trading these positions are taken significantly prior to the announcement of the deal and before any pre-announcements run up (run down) in target (acquirer) stock price has occurred.

planned; even the fact that there is such an announcement pending is not publicly known.... . Therefore, such events are ideal for studying which market tends to be the primary choice of informed traders and hence more conducive to information discovery.” This fact would be more pronounced by examining short-selling orders on the acquirer’s stock. This is because, compared to regular stock transactions, pessimistic trading through short sales and options is costly. In particular, short selling involves additional risks from short squeeze and cash collateral calls, and options trading demands a substantial spread to compensate its relatively low liquidity. In that sense, speculators will have less incentive to execute their orders through such venues, unless they possess superior information about the exact acquirer and are able to execute their orders in a prompt manner.

We recognize that hedge fund profits from trading prior to M&As can come from superior managerial and investment skills rather than from trading on insider information. We provide a number of tests that seek to identify trading activity arising from material insider information, controlling for hedge fund skills whenever possible. While we do provide tests based on a potential channel of insider information leakage prior to M&As, we recognize that cleanly separating hedge fund managerial skills from opportunistic trading utilizing leaked insider information is extremely difficult. Overall, our results from the full battery of tests we conduct are suggestive of some short-term hedge funds opportunistically taking advantage of material non-public insider information after controlling for skills, i.e. hedge fund modelling expertise through more efficient use of public or proprietary information.

Overall, our results can be summarized as follows: First, we find that short-term hedge funds’ holdings of target shares in the quarter prior to the public announcement of the M&A are positively related to the target’s premium and negatively related to deal characteristics, such as

completion status. In addition, we also find that the target's price run-up, prior to a deal's public announcement date, is significantly greater for deals with greater short term hedge fund holdings. Many papers, such as Schwert (1996) and Meulbroek(1992), argue that a positive target price drift up prior to an M&A announcement indicates misappropriation of material non-public information. Second, we show that short-term hedge funds' M&A investment strategy is in general very profitable. In particular, we find abnormal level of short selling and put buying in the corresponding acquirer's stock prior to the public announcement of the M&A, particularly when short term hedge funds take larger stakes in target firms.

The empirical M&A literature (such as Betton, Eckbo, and Thorburn, 2008) demonstrates that the acquirer's average announcement returns (AAR) is significantly negative in all-stock deals, while the AAR for deals with other types of payment, including mixed and all-cash deals, tends to be insignificant or positive. In our analysis, related to short-selling, we therefore, initially focus on stock payment deals (as potential profits from such deals will be greater) and then extend our investigation by including cash and mixed payment deals. In addition, we also find that target firms experience significant call buying in the quarter prior to the announcement of deals in which short-term hedge funds invest intensively.

We then try to identify potential channels for the source of information leakage based on anecdotal evidence and prior research. Our results show that the intensity of short term hedge fund holding in target firms is positively associated with a greater reliance by the acquirer on external financing, of the deal and where the number of target advisors (investment banks and lawyers) are greater. The premise is that the greater the number of people that are privy to inside information in such deals, the unconditional probability of an inside information leakage will be greater.

To rule out alternative explanations regarding short-term hedge fund M&A trading profits, we conduct our analysis in three distinct stages. In each stage we attempt to eliminate an alternative explanation, or provide some evidence, about the potential nature of the source of information for short-term hedge funds' trading prior to the public announcement of an M&A deal. In the first stage, we investigate whether the pre-announcement buying and selling activity of short term hedge funds around takeovers is based solely on publicly available information such as a firm's financial reports and market information. We do this by conducting tests using propensity score matching based on historical firm characteristics so as to match actual targets to potential targets with similar characteristics. This analysis helps to rule out the explanation that short-term hedge fund trading patterns are solely based on publicly available firm characteristics and historical information.

In the second stage, we provide a number of tests that seek to identify whether a short-term hedge fund's M&A strategy is profitable and whether its trading behavior is more suggestive of superior investment skill rather than insider information leakage. In this second stage, we first compare the trading patterns and profitability of short-term hedge funds with short-term *non*-hedge fund institutional investors. We find that the short-term hedge funds tend to hold a larger share in targets that have a higher target premium and also in targets that have higher short-selling in the corresponding acquirer's stock. Moreover, the price run-up of the target's stock, prior to the public announcement of the M&A, is significantly greater when short-term hedge funds hold a larger stake of the target stock.

Since these results may also be indicative of short-term hedge funds having superior ability or skills compared to other institutional investors, we subsequently compare the performance of those short-term hedge funds involved in the most profitable deals with those

involved in the least profitable deals. In particular, we find that the returns of those short-term hedge funds that were associated with deals with high levels of abnormal short-selling and target premiums do not out-perform peers that are associated with deals having a low levels of abnormal short-selling and target premiums. This seems contrary to what one might have expected if short term hedge funds did possess superior skills in predicting M&A activity. Additionally, we consider another group of tests in which we focus our analysis at the hedge fund level. In each quarter, we sort short term hedge funds into two groups based on their “*participation*” in M&A deals in the prior year. We then investigate whether those short term hedge funds that had participated in the greatest number of deals, were better able to identify profitable deals in the following quarter, relative to the remaining short term hedge funds in the sample. Our results show that there is no significant difference in the deal profitability characteristics for the two groups. This appears to be inconsistent with the skill based explanation, as repeated participation in prior deals by a hedge fund might imply superior ability at identifying potentially profitable M&A targets.

Finally, in the third stage of our analysis, we employ multivariate tests to investigate whether the trading patterns of short-term hedge funds are suggestive of trading on insider information. We adopt an approach from the prior literature (see, Christophe, Ferri and Angel, 2004), to investigate the level of pre-announcement informed short-selling and put-buying of the acquirer’s shares. The intuition is that if short-term hedge funds possess insider information about an M&A deal and the target firm, they would also be more likely to trade on the same information in the corresponding acquirer’s stock. We find evidence that is consistent with informed short-selling and put buying in the corresponding acquirer’s stock, especially when

short-term hedge funds hold larger stakes in target firms. However, we do not find similar evidence for short-term non-hedge fund institutional investors.

We then seek to identify the potential sources of information leakage. Given the nature of information leakage in M&A deals (as evident from recent SEC convictions, where information leakages have been recorded in many different ways), it is almost impossible to directly establish a link in a large sample study such as ours without knowing ex ante the channel of the information leakage.¹⁰ Since information leakages can happen from a large set of sources it is also not possible to generalize a strategy that will capture all such possible leakage around M&A events.

Instead, based on anecdotal evidence and prior research, we rely on identifying an indirect channel of potential information leakage. In particular, the larger the number of external parties (external to the target or the acquirer) involved in a deal, the higher the likelihood of an inside information leakage. As discussed more fully below this is because as the number of external agents involved in a deal becomes larger, more people possess material non-public insider information prior to the public announcement of a deal, thereby increasing the unconditional probability of an information leakage. Such a sentiment is echoed in the paper by Keown and Pinkerton (1981) and a recently released practitioner study.¹¹ Based on this, we expect to observe the intensity of short term hedge fund holdings to be higher for deals that are externally financed and have a large number of advisors. Our results show that short term hedge

¹⁰ According to the SEC litigation complaints, tipplers include, target/acquirer employees (Yahoo & RiverSource case), company executives (Riley & Foundry case), board directors (Peterson & Mariner), credit analysts for due diligence evaluation (Galleon & Hilton case), employee of legal advisors (3Com & Cutillo case) and employee of financial advisors (Hollander & ABS case). The takeover tips have been transmitted to hedge funds through family members, previous classmates or colleagues, personal investment advisors, etc.

¹¹ *M&A Confidential, What Happens when Deals Leak*, conducted by the M&A Research Centre at Cass Business School in U.K., and published in April 2013 by Intralinks, a firm that specializes in securely handling and sharing material non-public information among different parties during an M&A deal.

fund holdings are greater when a deal is funded externally and when more target advisors are involved in the M&A deal.¹²

The remainder of this paper is organized as follows. In Section 2, we describe our data. In section 3, we present our methodology and empirical results. Section 4, provides some robustness checks. Finally, Section 5 concludes.

2. Data Description

We consider all announcements of merger deals (both completed and withdrawn) between January 1, 2000, and December 31, 2007 as identified by the Securities Data Corporation (SDC) M&A database. We apply the following filters commonly used in the prior M&A literature (see Betton, Eckbo, and Thorburn, 2008, and Gaspar, Massa, and Matos, 2005). We keep all offers where the acquirer seeks to own 100% of a target's shares, while excluding divestitures, spin-offs, repurchases, self-tenders, and transactions whose value represents less than 1% of the acquirer's or target's stock market capitalization 46 trading days prior to the announcement, so as to ensure that the takeover has a reasonable probability of an impact on the stock price of the firms involved in the deal. We then group each M&A deal into either a stock, cash, or mixed payment category according to its contract terms. We require that both acquirer and target firms be available on CRSP and Compustat, and that they be listed on NYSE, Amex, or Nasdaq. The above data screens leave us with 1,271 deals. For all deals, we manually check the announcement date of the M&A deal from news articles by searching through *Factiva* and

¹² It should be noted that our definition of external financing also includes the identity of the lender. Since firms have revolving lines of credit from commercial banks and since banks are regulated and typically considered quasi-insiders, we treat loans made by commercial banks as internal financing. Thus our external financing variable is equal to one only when the lead lenders of the loan (as identified from DealScan) are non-bank institutions and hedge funds. Massoud et. al. (2011) shows that information leakage happens in syndicated loan markets when hedge funds act as lead lenders.

Lexis Nexis. Next, we obtain analyst coverage from I/B/E/S, option trading data from OptionMetrics, institutional holdings data from 13F CDA/Spectrum, loan data from Thomson Dealscan and collect short selling data made available in the RegSHO period (January 2, 2005 to July 6, 2007).

To identify a hedge fund's long positions in an M&A transaction, we first identify hedge funds and hedge fund advisors. To do this, we construct a comprehensive database of hedge funds by combining seven databases used in the prior literature. Second, we collect information on hedge funds' long holding positions from three types of SEC ownership disclosure filings, 13D, 13F and 13G. We obtain the underlying forms directly from SEC filing system since they provide greater detail about the identity of a firm's shareholders.¹³ The details of our hedge fund identification and ownership data are provided in the Online appendix of this paper. Finally, we integrate stock ownership data from these three different SEC filings into one dataset. Our data is organized quarterly due to the reporting nature of Form 13F. However, since 13D and 13G are not quarterly filings but rather filed when required, we define the quarter before the announcement as well as the days in the actual announcement quarter prior to the announcement day as quarter (-1); the days after the announcement day in the announcement quarter as quarter (0); and the remaining quarters as following the calendar quarters relative to the announcement date. For example, a merger announcement on July 17th 2007 would have the days April 1st 2007 to July 16, 2007 in quarter -1. In particular, we define a short-term investor as a financial institution or individual who does not maintain a long-term relationship but takes a long (buy) position in the target firm shortly before the public announcement of the M&A deal. Specifically,

¹³ To retrieve the name and precise ownership information for all hedge funds in our sample, we collect 171,806 original Form 13F files from Edgar Online database from 1999 to 2007 for 4,674 reporting entities along with the jointly reporting managers. We also collect all publicly available SC13G (391,368 forms) and SC13D (141,079 forms) from SEC for 16,045 and 18,732 reporting entities respectively from 1999 to 2007.

we define an investor as a short-term investor if the following two criteria are satisfied. (1) the investor reports a positive holding in the target in either 13F and/or SC13D/G filing in quarter [-1], and (2) the investor reports no holdings in the target in each quarter from quarter [-4] to quarter [-2].¹⁴ Detailed descriptions of these steps are provided in the Online Appendix. We report the distribution of these data in Table I and Figure I.

[Insert Table I and Figure I]

Table I reports the number of beneficial owners of firms involved in M&A deals annually in our sample. Between 2000 and 2007, there are 716 M&A transactions with at least one institutional beneficial owner (13D/G filer) for the target and/or acquirer's shares between the period four quarters prior to two quarters after the M&A announcement. As can be seen from Figure I, there is a strong upward time trend of hedge fund beneficial ownership in our sample, especially in target firms. Conversely, the number of other institutional beneficial owners remains relatively unchanged during the sample period, consistent with prior evidence (Greenwood and Schor, 2009).

A comparison of the descriptive statistics of hedge fund and non-hedge fund institutional holdings for our sample of 1,271 M&A transactions shows that hedge funds in general tend to increase their stake more in target firms relative to non-hedge fund institutions in the quarter prior to the announcement. In particular, in quarter (-1) the increase in mean hedge fund holding relative to quarter (-4) is 37.88% while it is 18.4% for other institutional holders.¹⁵

¹⁴ Since Bodnaruk, Massa, and Simonov (2007) argue that investment banks possess insider information and their stakes are related to target premium, to avoid the mixed effect from hedge funds affiliated to investment banks and to focus our study on the role played by short-term hedge funds, we remove several hedge funds from our sample, which are identified by our hedge fund database and are also identified as an investment bank by SDC in the 3 years before each M&A deal. This filter would exclude hedge funds associated with financial conglomerates such as JP Morgan, for example.

¹⁵ Due to space constraints, we summarize the key result of the descriptive statistics here. The table with detailed descriptive statistics is presented in the online appendix to this paper, available at: http://people.brandeis.edu/~dnandy/research_brandeis.html

We collect our short sales data from the New York Stock Exchange (NYSE) TAQ database and the websites of the other major US Exchanges that are Self-Regulatory Organizations (SRO's), namely, the American Stock Exchange (AMEX), the National Association of Securities Dealers Automated Quotations (NASDAQ), the National Stock Exchange (NSX), Archipelago (ARCA), the Boston Stock Exchange (BSE), the Chicago Stock Exchange (CHX), the National Association of Securities Dealers (NASD) and the Philadelphia Stock Exchange (PHLX). On June 23, 2004, the SEC adopted Regulation SHO (REGSHO) under the Securities Exchange Act of 1934. Under the initial requirements of *REGSHO*, all SROs were obligated to make tick-by-tick short sales data available to the public after January 1, 2005. These short sales data include information on ticker name, short sale volume, short sale price, transaction time and date, exchange listing, and trade type (whether exempt market maker trades or not). These data are available from the first effective compliance day January 2, 2005 to July 6, 2007 after which date the mandatory public disclosure of short sales data was discontinued.

We start by aggregating the raw data at the transaction level to a daily level by ticker symbol, trading date, and the stock exchange on which the stock is traded (some stocks might be traded on more than one exchange). During this aggregation process we exclude exempt market maker trades as such trades are not information driven. We then merge this daily short sale database with CRSP daily price data by ticker and date, and verify our merged results by comparing the daily average short prices with CRSP stock prices. We then keep the short sales data for stocks listed on the NYSE, AMEX and NASDAQ and generate aggregated daily non-exempted short sale volumes for each stock.¹⁶ This leaves us with a short sale sample consisting of 3,117 NYSE stocks, 1,353 AMEX stocks, and 3,915 NASDAQ stocks.

¹⁶ Non-exempted short sales exclude short sales made by the market maker.

3. Method and Results

In this section we present our empirical results according to the three stages of our analysis as discussed in the Introduction.

3.1 Stage One: Publicly Available Information

In the first stage of our analysis, we investigate whether short-term hedge funds adjust their ownership in target firms primarily based on public information regarding firm fundamentals. We do this by employing propensity score matching. The propensity score matching algorithm allows us to examine short-term hedge fund holdings of the treatment (actual target) firms, in comparison to their holdings in a matched control group of firms (similar firms but not takeover targets). These tests are implemented in four steps. In the first step, we use a logit regression where the binary dependent variable is one for takeover targets and zero for firms that are neither acquirers nor targets in any M&A deal during our sample period. This also allows us to identify the fundamental characteristics that make a firm more likely to be a potential takeover target. Following the standard M&A literature, see for example Schwert (2000), we include a number of market and accounting variables that are widely used in such prediction models, such as sales growth, ROE, etc. In addition, we include *Buy-and-Hold* returns to control for the firm's stock market performance and the *Herfindahl-Hirschman index* (HHI) to control for the degree of competitiveness in the firm's industry. We also include the firm's aggregate level of institutional ownership from CDA/Spectrum 13F and Amihud's illiquidity ratio as additional control variables to proxy for firm specific information asymmetry.¹⁷ In the second step, we calculate each firm's propensity score based on the probability that a firm with given fundamental characteristics will become a target. In the third step, firms are matched using Leuven and

¹⁷ A greater extent of institutional ownership of the firm's shares and lower stock illiquidity signals a lower degree of firm specific information asymmetry.

Sianesi's (2003) propensity score matching procedure to the nearest neighborhood within a 0.1 caliper. Specifically, we match the actual and potential target within the same Fama-French 49 industry category and year, and then compute the differences in the control variables between the treatment and control firms to establish the quality of our matches. In the final step, we employ univariate tests to compare the hedge fund and short-term hedge fund long positions in the actual and matched potential targets around M&A dates.

[Insert Table II]

Panel A of Table II reports the regression results from three logit models. Given the consistent results across these models, we choose Model (3), with highest pseudo R-square, to conduct the propensity score analysis and match the actual and potential targets. We report the quality of our matches in Panel B of Table II. The results of these tests show no significant difference among the market and accounting performance measures between matched pairs of treatment and control firms. Panel C of Table II shows that hedge funds tend to take larger stakes in actual targets compared to their matched control firms in all four quarters prior to the announcement. We analyze our main key variable, short-term hedge fund holdings in Panel D of Table II. The results in Panel D shows that short-term hedge funds hold significantly greater long positions in the actual target's shares in quarter(-1) relative to matched firms. This test tends to rule out the potential explanation that short-term hedge funds are able to identify target firms prior to the public announcements of M&A deals, purely based on historical market and accounting fundamentals.

3.2 Stage Two: Do Short-term Hedge Funds Have Superior Ability?

In this stage, we conduct a variety of tests to investigate the trading patterns of short-term hedge funds and the profitability of such trades prior to the public announcement of M&A deals.

In some of these tests we benchmark their performance to that of non-hedge fund short-term investors to distinguish their investment strategy with that of other investors who also build a long position in the quarter right before announcement. In an attempt to shed light on the success of their M&A investment strategy, along with those tests, we examine certain characteristics of short-term hedge funds, such as their long-term performance, and abnormal preannouncement trading patterns at the deal level, such as short selling in the corresponding acquirer's stock. We first present our univariate tests followed by our multivariate analysis.

3.2.1 Univariate Analysis

In this section we investigate whether short-term hedge funds could potentially construct a profitable strategy either due to their superior investment skills or by trading on insider information prior to the announcement of an M&A deal. Our measurement of profitability takes into account both long positions in targets as well as short positions in the corresponding acquirer. Though we cannot identify the traders in a short position, given the magnitude of short-selling executed by hedge funds, it is reasonable to believe that short-term hedge funds are more likely to short acquirers prior to an M&A announcement.¹⁸

A. Measuring Profitability from Target Premiums

First, we evaluate the accuracy and profitability of short-term hedge funds investment strategies based on the characteristics of the deals they participate in. Based on Schwert's (2000) definition of target premium, and following Bodnaruk, Massa, and Simonov (2009), we measure the target premium as the Fama-French four-factor return of the target's stock from three months (63 trading days) prior to the deal announcement to two months (42 trading days) after the deal

¹⁸ According to the research report by Goldman Sachs (2009), hedge funds account for 85% of equity short position. Moreover, given the fact that hedge funds are also active players in option market, their bearish bets by using put options would cause the market makers to hedge their positions and eventually generate additional short volumes. In this sense, though we do admit that we are limited in the short seller identifications, we cannot rule out the potential link between the short term hedge funds and the preannouncement abnormal short selling and put buying activities.

announcement or the resolution date, whichever comes first, i.e.:

$$premium = \sum_{-63}^{\min(42, \text{Resolution Date})} (R_{it} - \alpha_i - \mathbf{X}\beta)$$

where R_{it} is the continuously compounded return on target firm i on trading day t relative to the takeover announcement date and \mathbf{X} is a vector of the Fama-French four factors, MKT, SMB, HML, and UMD on trading day t . The coefficients are estimated on the 255 trading days ending at day -64 . We also separate the Fama-French four factor returns into the previous month's "run-ups" and following 2-month (0, 42) "markup".

In Figure III, we present a graph depicting the Fama-French four-factor adjusted cumulative abnormal returns around M&A announcements of firms with high short-term hedge fund holdings versus firms with low short-term hedge fund holdings. We classify a firm in a deal as a firm with high (low) short term hedge fund holdings, if the short-term hedge fund ownership in the target firm is above (below) the 67th (33rd) percentile of the distribution of short-term hedge fund holdings in target firms in our sample.

[Insert Figure III]

Figure III suggests that target firms with high short-term hedge fund holdings also have high premiums relative to targets with low short-term hedge fund holdings. Conversely, acquirers that have large short-term hedge fund holdings in their corresponding targets underperform acquirers that have low short-term hedge fund holdings in their targets. As argued by the existing literature (e.g. Bodnaruk, Massa, and Simonov, 2009), this preliminary evidence suggests that short-term hedge funds trading could be linked to material non-public information. Additionally, as can be seen from the graph, for the high short-term hedge fund holding group

there is a significant run-up of the target's stock price prior to the deal announcement date.¹⁹

B. Measuring Abnormal Short-Selling and Put Buying on Acquirer Shares

In addition to buying a target's shares in high premium deals, another component of a potentially profitable strategy for short-term hedge funds in a stock deal, is to short-sell the shares or buy the puts of the acquirer *prior* to the public announcement of the deal. It is well documented that in stock deals the acquirer's stock price on average falls around the time of the M&A announcement (see, e.g., Boone and Mulherin, 2007). Figure IV indicates the average abnormal short-selling and abnormal put-buying prior to the M&A announcement for acquiring firms in stock deals, where "abnormal" is defined below. Similar to Figure III these results are also categorized by high and low short-term hedge fund holdings in corresponding target firms.

To examine the level potential informed trading, we investigate the abnormal short selling and abnormal daily net put option buying of an acquirer's stock in the 5-day and 10-day windows prior to the public announcement of the deal. Following Christophe, Ferri, and Angel (2004), we define abnormal short-selling as the difference between the average daily short selling in the acquirer's shares for the five (ten) trading days prior to the M&A announcement date and the average daily short selling in acquirers' shares during a non-event window prior to the merger. This average short selling, *AVESS*, is measured over 255 trading days ending at day -64 (i.e., -318 to -64). We require short selling records for a minimum of 63 days during this window.²⁰ For example, the abnormal short-selling $ABS(-5,-1)$ of one stock during the five days prior to announcement is formally measured as:

¹⁹ Interestingly, this run-up in the target's stock price is similar to that in several M&A deals currently under SEC investigation, such as Schering-Plough Corp's stock prior to its takeover by Merck & Co. in 2009, and MedImmune Inc.'s stock prior to its takeover by AstraZeneca PLC in 2007. See *Wall Street Journal*, November 20, 2010, "U.S. in Vast Insider Trading Probe", by Pulliam, Rothfeld, Strasburg, and Zuckerman.

²⁰ For deals with less than 63 days of short selling data prior to day -64 the average short selling is measured over the 255 trading days after day 0. We consider this alternative window to keep the sample size relatively stable. We also used alternative windows, finding qualitatively similar results.

$$ABSS(-5,-1) = \frac{SS(-5,-1)}{AVESS} - 1$$

where $SS(-5,-1)$ is the average daily number of shares that are short sold during the five days prior to the announcement.

We calculate the net long put option volume for each type of put option for the underlying stock on each trade date by subtracting the long (short) put open interest on that trade date from the long (short) put open interest on the previous trade date. Following Poteshman's (2006) methodology, we define $ABLongPut(-5,-1)$, for example, as the average of the -5 to -1 day abnormal net long put volume, which is measured as

$$ABLongPut_t = \frac{\sum_{j=1}^{N_{i,t}} NVOL_{i,j,t}^{LongPut} - (1/255) \sum_{k=64}^{318} \left(\sum_{j=1}^{N_{i,t}} NVOL_{i,j,t-k}^{LongPut} \right)}{std. \left(\sum_{j=1}^{N_{i,t}} NVOL_{i,j,t-k}^{LongPut}, k = 64, 65, \dots, 318 \right)}$$

where $NVOL_{i,j,t}^{LongPut}$ is the daily net long volume on the j^{th} type put option on underlying security i on trade date t .

[Insert Figure IV]

Panel A of Figure IV shows that, when short-term hedge funds hold higher long positions in targets, the shares of the corresponding acquirers are more likely to be abnormally sold short *prior* to the M&A announcement than the shares of acquirers corresponding to targets in which short-term hedge funds have lower long positions. Panel B of Figure IV also shows a similar pattern of trading on the acquirer's net long put options based on the same classification of high and low short-term hedge fund holdings in targets.

C. Relationship between Intensity of Short-term Hedge Fund holdings and Profit Measures

In Table III, we present a summary of target premiums, target run-up, and abnormal short sales and put option trading volumes in the Reg. SHO period, a period in which we have all variables of interest available. In addition, we also provide other related characteristics, such as risk arbitrage returns, acquirer run-up and mark-up, and other deal characteristics. Table III describes how these variables differ across deals associated with short-term hedge fund and other short term non-hedge fund institutions' ownership of a target's shares. Panel A of Table III examines all M&A deals, while Panel B only examines the deals with stock payments. Column 1 of Table III provides the mean and median values for sample characteristics with positive short-term hedge fund ownership, while the following 2 columns provide statistics for subsamples associated with below median (low) and above median (high) short-term hedge fund stakes in a target's shares, respectively. Column 4 displays the level and significance of differences between the two subsamples. The remaining columns for other short term institutional holdings are constructed in the same way.

[Insert Table III]

Panel A shows that the target premium for high short-term hedge funds holdings is significantly higher. In particular, the mean (median) of premium is 31.37% (26.57%) for targets in the high hedge fund group while it is 20.09% (19.96%) for targets in the low hedge fund group. The difference is significant at the 1% level. However, the difference is not significant for the non-hedge fund institutions short-term holdings of the target's shares. Similarly, the target run-up for the high short-term hedge fund holdings is also significantly higher than that of the low group. While the difference is significant at the 5% level for the hedge fund groups, it is insignificant for the non-hedge fund short-term institutional investor groups. As expected, the results for the stock deals (see Panel B) show that compared to the low group, the high group has

higher target premium and higher abnormal short selling of acquirer's shares for the different windows with the differences being statistically significant.²¹ Such differences in target premium and abnormal short selling however does not exist between the high and low short-term non-hedge fund institutional investor group.

Anecdotal evidence, such as that revealed in the Galleon and Clearwire case, suggests that hedge funds with illegal material information also utilize call options, in addition to take a long position of target. We then investigate call buying of target shares for high versus low short-term hedge funds in target in the quarter prior to announcement. Our definition of abnormal net long call volume is similar to our definition of abnormal net long put volume above. We find significantly larger call buying for the deals with high short-term hedge fund stakes, but the difference with short-term non-hedge fund institution stake categorized deals is not significant, see Panel A in Table III.

D. Profitability of Short Selling Strategy

So far our univariate results show that short-term hedge funds are more likely to hold larger stakes of a target, when target premiums are higher. We also found that the corresponding acquirer's shares are more likely to experience a high level of abnormal short selling during the period prior to the deal announcement date. An important question to ask is whether these short selling activities, prior to the public announcement of M&A deals, are profitable? In our analysis we find that short sellers, in the high short-term hedge fund sample, could make economically significant profits if they closed their positions on day 0 or after. In comparison, the short sellers

²¹ It is important to note however, that the risk arbitrage return (i.e., the return based on the traditional merger arbitrage strategy that many hedge funds employ) is not different and statistically insignificant between the high and the low groups. Thus, the potential higher returns that accumulate to the high group (due to the significantly higher premium and significantly heavier short-selling) cannot be explained by such merger arbitrage strategies.

of the low short term hedge fund group would mostly generate losses following a similar strategy.²²

E. Persistence in Short-Term Hedge Fund Profitability.

As we have shown above, short-term hedge funds generate abnormal profits by holding target stocks as well as short selling acquirer's stock, especially in stock payment deals. However, these profit patterns could be explained by either superior investment skills of short-term hedge funds or by such hedge funds taking advantage of insider information. One way we attempt to shed light on this issue by examining the long run performance of short-term hedge funds. The SEC litigation complaints suggest that the insider information arrives in a random pattern even for the most avaricious hedge funds. On the other hand, skilled investment managers should be able to predict upcoming M&A deals in a more systematic pattern, since their superior ability (and models) would ultimately rely on private and publicly available information but not insider information. In this and the following subsection, we examine the persistence of short-term hedge fund performance, in terms of profitability and predictability respectively.

In this section, we examine the persistence of short-term hedge fund profitability. We double sort M&A deals by short-term hedge fund holdings and abnormal short selling, first sorting all deals into above median and below median groups based on short-term hedge fund holdings in the quarter prior to the M&A announcement. Deals within each group are then assigned into above median and below median groups based on the level of abnormal short sales in the corresponding acquirer over the 10 day period prior to the M&A announcement date. The importance of this test is that it investigates the profitability of the deal while combining three

²² A detailed analysis of short-term hedge fund profitability from short selling the acquirer's stock is presented in the online appendix to this paper, available at: http://people.brandeis.edu/~dnandy/research_brandeis.html

pieces of the puzzle: the short-term hedge fund holding in the target, the abnormal short selling in the corresponding acquirer and the timing of the public announcement of the deal.

[Insert Table IV]

In Table IV, Panel A, we report the cross-sectional averages for firms in the Low-Low (below median class for both abnormal short selling and short-term hedge fund holdings) and in the High-High (above median class for both abnormal short selling and short-term hedge fund holdings) groups. In Table IV, we also introduce one more measure of profitability, total return, which is measured by subtracting the acquirer's CAR from its target's premium measured over the same event window. We measure the abnormal profit from shorting acquirer's shares by aggregating the average of the potential daily profits calculated by short selling acquirers' shares during the windows (-10, -1) or (-5,-1) and closing the positions during the windows (0, 10) or (0, 5). Consistent with our previous results, the target premium, acquirer abnormal short selling and short term-hedge fund holdings of the target's shares is larger for the high-high group for all deals (left panel) and for the stock deals (right panel). Further, we find that the total return is significantly greater for the high-high deals compared to the low-low deals. As expected, the profitability due to short selling the acquirer's shares is significantly larger for the high-high group for stock deals.

Further, in Table IV Panel B, we report the average long term past performance of the hedge funds associated in the low-low as well as the high-high group using two alternative methodologies, namely, market adjusted returns and returns based on a seven-factor model used in the prior literature, Kososki, Naik, and Teo (2007).²³ Market adjusted returns are computed by

²³ We collect performance data for hedge funds from TASS, HFR, and CISDM. In case a short term hedge fund is matched as a target shareholder at the management company level, we take the average performance of all hedge funds under the management company as the measure of the performance for the management company. The hedge

subtracting the observed return on the corresponding hedge fund database indices for month t , $R_{I,t}$, from the return of the j^{th} hedge fund in that database on month t :

$$MAR_{j,t} = r_{j,t} - r_{I,t}.$$

The seven factors are S&P 500 monthly total return minus the risk-free rate (Equity Market), Russell 2000 index monthly total return minus S&P 500 monthly total return (Size Spread), change in the constant maturity yield of the 10-year Treasury (Bond Market), change in the spread of Moody's Baa minus the 10-year Treasury (Credit Spread), as well as bond, currency, and commodities trend following factors. These factors have been shown to strongly explain the variation in individual hedge fund returns. To evaluate the performance of hedge funds, we consider the model below:

$$r_t^j = \alpha^j + \sum_{k=1}^K \beta_k^j F_{k,t} + \varepsilon_k^j.$$

We use the intercept from the regression (the alpha) above to represent the abnormal performance of hedge fund j after controlling for its risk exposures. In Table IV Panel B, we report the abnormal returns based on the above regression for 2 and 5-year periods prior to the takeover announcement.

As can be seen from Panel B, the short-term hedge funds in the high-high group do not outperform those in the low-low group with respect to 2 year and 5 year past returns, which might have been expected if short-term hedge funds in the high-high group possessed superior ability or investment skills than those in the low-low group. For example, the market adjusted returns over five previous years for stock deals are lower for high-high group (-1.1%) than for

fund monthly performance data are primarily based on TASS, and the data from HFR or CISDM are used only when the monthly returns are not reported in TASS.

the low-low group (4.4%), though the difference is not statistically significant. These results therefore suggest that short-term hedge fund trading patterns prior to the public announcement of M&A deals is less likely to be primarily based on their superior ability of processing available public information.

F. Persistence in Short-Term Hedge Fund Predictability

In this sub-section, instead of focusing on the deal level directly, we investigate whether the most active short-term hedge funds, as defined by past M&A participation, can consistently predict M&A deals prior to their public announcement. Our intuition here is that if active participation in M&A deals the past signifies greater skill in predicting such deals, then such prediction skill should be persistent in the future as well. We first sort all short-term hedge funds in each quarter by the number of M&A deals that the hedge fund participated in the calendar year prior to the quarter. We then examine target premium, run-up, and other statistics between the deals in the subsequent quarter, that are participated by the most active hedge funds in the top 90th, 95th and 99th percentile and the rest of the short-term hedge funds respectively. If a hedge fund possesses superior skill, we should expect this hedge fund, which has most actively participated in M&A deals in the past year, to be more likely to participate in deals with large target premium in the subsequent quarter. The short-term hedge funds in the top 90th percentile in our sample participate in 5 to 13 deals in each quarter with a stake that varied from 4% to 10%. We then investigate whether those short-term hedge funds in the top percentiles were able to better identify M&A deals in comparison to the rest of the sample. Our results in Table V shows that there is no significant difference in any profitability measures (*Target Premium*, *Target Markup*, and *Acquirer CARs*) for the deals that top percentile hedge funds participated in versus the remainder of the sample. These results are not consistent with a belief that certain short-term

hedge funds are skilled at identifying potential M&A deals prior to public announcement based solely on non-material public information. On the other hand, these results, along with the profitability analysis in the prior subsection, suggest that exploitation of insider information may be deal specific and not hedge fund specific.

[Insert Table V]

In summary, our results in this section provide evidence that the trading patterns of short-term hedge funds prior to the announcement of M&A deals is significantly profitable. In addition, trading patterns are not indicative of a superior ability or skill to process non-material publicly available information.

3.2.2. Multivariate Analysis

In this section, we extend our univariate tests into a variety of multivariate tests, to see whether the evidence found in the univariate tests still holds after controlling for a variety of other effects.

A. Target premiums and short-term hedge fund holdings

We first investigate whether short-term hedge funds holdings of target shares, prior to the public announcements of an M&A, is positively related to a target's premium after we control other important characteristics that are related to M&A deals. We test this formally by using the following model:

$$\begin{aligned}
 Holding = & \alpha + \beta_1 Premium + \beta_2 Success + \beta_3 Markup + \beta_4 Runup \\
 & + \mathbf{X}_{Deal\ Charactors} \boldsymbol{\kappa} + \mathbf{X}_{Controls} \boldsymbol{\varphi} + \varepsilon
 \end{aligned} \tag{1}$$

where *Holdings* is the holdings of short-term hedge funds one quarter prior to the M&A announcement, *Premium* is the target premium, *Success* is a binary dummy variable relating to

the actual outcome of the deal (i.e., completed versus withdrawn), *Runup* and *Markup* are acquirer stock price run-ups and mark-ups (i.e., the acquirer's return following the announcement) discussed above, $\mathbf{X}_{Deal\ Characters}$ is a matrix for specific characteristics associated with M&A deals, and $\mathbf{X}_{Controls}$ is the set of control variables commonly employed in the M&A literature (see for example, Schwert, 2000). Our analysis focusses on the size and significance of β_1 .²⁴

[Insert Table VI]

In Table VI, we present our results for hedge fund holdings for the full sample (Panel A), the pre-2003 subsample (Panel B), and the post-2003 subsample Panel (C). During the time period from 2000 to 2007 we have 791 observations of M&A deals out of 1,271 that have positive short-term hedge fund ownership. In each panel, we examine two regression specifications to show the robustness of our results by including firm characteristics as controls along with year fixed effects. As expected β_1 is positive and significant in Panels A and C while it is insignificant in Panel B. The insignificance of β_1 in Panel B (the period pre-2003) is mostly explained by the changes in the M&A trend that occurred around 2003. As shown in Figure I, in the US, M&A activity peaked during 2000 and declined dramatically to a trough in 2002, following two years of economic recession. Specifically, the dollar value of M&A transactions in 2002 was only 25.85% of that in 2000. The resurgence in M&A deals over the 2003-2007 period has been viewed as a new wave of M&A activity (see DePamphilis, 2009). In addition, Klein

²⁴ Larcker and Lys (1987), argue that merger arbitragers may positively affect the expected probability of an M&A's success, namely $\beta_2 > 0$ in (1), since they typically tender their shares to the acquirer. However, on the other hand, since the target price tends to adjust upward to the announced target premium rapidly around the M&A announcement date (see for example, Schwert, 1996), short-term hedge funds may not wait until the completion of an M&A to realize their profits. This in turn may reduce the probability of deal success since these shares are not tendered directly to the acquirers. Further, anecdotally it is also believed that short term hedge funds tend to sell most of their target stock holdings right after the M&A announcement date. Indeed, our results in Panel D of Table II support this anecdotal evidence. Thus, whether the impact on deal success, i.e., β_2 is positive or negative is ultimately an empirical question.

and Zur (2009) show that hedge fund filings increased dramatically in 2003 and after.²⁵

B. Preannouncement Short-Selling, Put-Buying and Short-term Hedge Fund Holdings

In this section, using multivariate regressions, we investigate the relationship between the preannouncement abnormal short-selling of the acquirer's equity, the buying of puts on the acquirer in the options market and the short-term hedge fund holdings of a target's equity. Following Christophe, Ferri, and Angel (2004) and Poteshman (2006), we construct two regression models as follows:

$$ABS(-5, -1) = \beta_0 + \varphi_1 Holding + \varphi_2 Stock \times Holding + \beta_1 RET(-5, -1) + \beta_2 ABVOL(-5, -1) + \varepsilon \quad (2)$$

$$ABLongPut(-5, -1) = \delta_0 + \varphi_1 Holding + \varphi_2 Stock \times Holding + \delta_1 RET(-5, -1) + \delta_2 ABVOL(-5, -1) + \delta_3 ABOPTVOL(-5, -1) + \varepsilon \quad (3)$$

where $RET(-5,-1)$ is the return on the acquirer stock on days -5 to -1, $ABVOL(-5,-1)$ is the average daily abnormal trading volume in the acquirer stock over the interval of day -5 to -1, $NORMRELSS$ is the ratio of shorted shares to traded shares for the acquirer's stock during the pre-announcement period which is defined outside the event window, i.e., outside of days (-63, 0), and $ABOPTVOL(-5,-1)$ is the average daily abnormal long(short) option position in the acquirer's stock (both put and call) over the interval of days -5 to -1. As suggested by Christophe, Ferri, Angel (2004) and Poteshman (2006), the variables $RET(-5,-1)$, $ABVOL(-5,-1)$ and $ABOPTVOL(-5,-1)$ control for the contemporaneous movement of the stock price, stock trading volume, and option trading volume respectively. The variable $NORMRELSS$, is a cross sectional control for each firm's typical ratio of shorted shares to traded shares during the pre-announcement period. Our analysis is focused on the size and sign of φ_2 , the coefficient on *Stock*

²⁵ This is consistent with our results in Figure I and Table I which shows that the short-term hedge fund holdings increased dramatically after 2002. Thus, we employ a Chow test to see whether the holdings of short-term hedge funds in M&A's are similar in the sub-period before and after 2003. The Chow test confirms significant differences between the regression coefficients in the two sub-period samples.

× *Holdings* which is the interaction term identifying a short-term hedge fund's holdings in a stock deal.

[Insert Table VII]

Short selling data for the acquirer is only available for the Reg-SHO period, which leaves us with a sample of 277 firms. The results from regression 1, corresponding to equation (2) in Table VII, shows that there is a significantly positive relationship between preannouncement short-term hedge fund holdings of targets and the abnormal short-selling of acquirers $ABS(-5,-1)$ shares in stock deals (ϕ_2) during this period.²⁶

For our analysis on abnormal put option buying, during the post-2003 and Reg-SHO periods, i.e., columns 3 and 4 of Table VII, we find a significant and positive relationship between preannouncement hedge fund stakes in stock deals and put buying of acquirers one week prior to the actual M&A announcement date (ϕ_2). However, this result does not hold for M&A deals in the sub-period prior to 2003 (see Column 2 of Table VII). These results provide support to our earlier univariate results that the stocks of acquirers in M&A stock deals, in which short-term hedge funds hold large stakes, are more likely to be short sold (or have greater put buying in the acquirer's stock) prior to the public announcement of the deal.

3.3 Stage Three: M&A Timing and Channels of Information Leakage

In this stage, we consider two important issues: whether trading by short-term hedge funds in general is informative and whether we can identify the channel of the leakage of insider information.

3.3.1 M&A Timing and Short-term Hedge Fund Stakes

²⁶ Similar results are obtained when we consider an alternative measure of abnormal short selling, i.e., the relative short selling variable $RELESS(-5,-1)$.

In this section, we propose to use multivariate tests to directly investigate whether short-term hedge fund trading patterns are consistent with trading on material non-public information prior to the public announcement of M&A deals. One common approach in the literature (see, for example, Christophe, Ferri and Angel, (2004)), is to investigate the relationship between pre-announcement short selling and put buying and the post-announcement stock price change. We have already shown a relationship among pre-announcement short selling and put buying with short-term hedge fund holdings above. Here, we will focus on the relationship among pre-announcement short selling, put buying and stock return around announcement, i.e. whether the M&A event can be timed accurately by short-selling and put-buying activity prior to the public announcement of the M&A deal. If traders are able to infer the future stock price reaction to the announcement of an M&A event, then it is more likely that their trading patterns will reflect the exploitation of insider information on the “attractiveness” of the deal, in this case to the acquirer.²⁷ Accordingly, we consider the following two models:

$$ABS(-5, -1) = \beta_0 + \beta_1 RET(0, +1) + \beta_2 RET(0, +1) + \beta_3 RET(-5, -1) + \beta_4 ABVOL(-5, -1) + \varepsilon \quad (4)$$

$$ABLongPut(-5, -1) = \delta_0 + \delta_1 RET(0, +1) + \delta_2 RET(0, +1) + \delta_3 RET(-5, -1) + \delta_4 ABVOL(-5, -1) + \delta_5 ABOPTVOL(-5, -1) + \varepsilon \quad (5)$$

where the variable $RET(t_1, t_2)$, is measured as the return on equity from its closing prices on day t_1 to t_2 . The other variables are as explained above. Our proxies for informed short selling in equity and put buying in option markets are $RET(0, +1)$ and $RET(0, +1)$ interacted with above-median short-term hedge fund holdings (*abv Median*), i.e. β_1 and β_2 . The independent variable $RET(0, +1)$ is the acquirer’s announcement two-day return, which captures any element of surprise in the announcement of the M&A deal. Thus, a negative two-day return means that the

²⁷ For example, insider information regarding the price the acquirer is willing to pay for the target.

market views the M&A announcement as a negative event, and a positive return means that the M&A announcement was viewed as a positive event. Therefore, a statistically significant and negative β_1 means that short-selling rises prior to announcements that lead to a decrease in acquirers' stock prices. Similarly, if the coefficient β_2 on the interaction term of $RET(0,+1)$ and the above-median short-term hedge fund dummy are negative and significant it would be consistent with more market participants, in deals with high short-term hedge fund stakes in the target, *ex-ante* perceiving a negative market reaction to M&A deal announcements and accordingly increasing their short selling in the acquirer's equity.

Following Christophe, Ferri and Angel (2004), our regressions also contains two control variables. The first control variable, $RET(-5,-1)$, represents the movement of the stock price during the five days prior to the announcement.²⁸ The second control variable, $ABVOL(-5,-1)$, accounts for the potential contemporaneous correlation between abnormal short-selling and spikes in volume, and for the possibility that stocks experiencing sudden increases in volume might be easier to short.

[Insert Table VIII]

We use cross-sectional OLS regressions to estimate the two models in equations (4) and (5). There are 277 acquirer firms between January 3, 2005 and July 6, 2007 with short sale data while there are 221 acquirer firms with put option data during the same period (the Regulation SHO period).²⁹ We considered an acquirer firm to be in the low (high) short-term hedge fund holding group if short-term hedge fund holdings of a target are below (above and equal to) the

²⁸ This variable controls for the possibility that upward or downward changes in the stock price might affect the levels of short-selling in the days leading up to the announcement. A pre-announcement increase in stock price, for example, might affect short-selling by inducing some investors to short the potentially "over-valued" stock. By using this control variable, the model does not wrongly attribute all pre-announcement short-selling to expectations regarding the M&A deal.

²⁹ To conserve space we only report results for this period in the paper. Detailed results for our entire sample period as well as results for other cuts of the sample are presented in the online appendix of the paper, available at: http://people.brandeis.edu/~dnandy/research_brandeis.html

median of the distribution of all takeover target firms in a given year. Panels A and B of Table VIII present our results for equations (4) and (5) respectively for short-term hedge funds whereas Panels C and D presents the results for other non-hedge fund short-term institutional investors. As can be seen from Panel A, there is a significant negative relationship between the two-day announcement return, $RET(0,+1)$, and ex-ante abnormal short-selling, $ABS(-5,-1)$, and in the interaction term between $RET(0,+1)$ and the high short-term hedge fund group dummy. Similar results are obtained for put option buying (see Panel B). We also repeat these regression tests for short-term non-hedge fund institutional investors' holdings (in Panels C and D) and do not find any significant relationship between post announcement returns and abnormal short-selling for the high short-term non-hedge fund institutional investor group.

In summary, our results, suggest that the level of preannouncement informed short-selling (put buying) is significantly related to the size of stake in the target that the short-term hedge funds hold.³⁰ However, we cannot find similar patterns in the holdings of other non-hedge fund short-term institutional investors.

3.3.2 Potential Channels of leakage of information

Given the nature of information leakage revealed in recent SEC convictions and the number of existing litigation cases, it is almost impossible to establish a formal *direct* link between inside information leakage and short-term hedge fund holdings in a large sample study. Since information leakages can happen from a wide set of possibilities, it is also very difficult to create an empirical strategy that will capture all such possible leaks around M&A events. Consequently, we have defined an alternative way to identify the potential source of inside information leakage. In particular, academic papers and practitioner articles appear to agree that

³⁰ Our findings for options are also consistent with the Cao, Chen and Griffin's (2006) study which documents a strong relation between preannouncement option trading activity and takeover returns.

the possibility of inside information leakage is relatively higher in certain settings around M&As. Specifically, they imply that on average the larger the number of external parties (external to the target or the acquirer firms) involved in an M&A deal, the greater the possibility of an inside information leakage. Intuitively, when the network size of the external parties involved in the deal grows, more people possess material non-public information prior to the public announcement and therefore the unconditional probability of an information leakage increases.

These sentiments are evident in a recent practitioner oriented study released in April 2013, by a firm that specializes in securely handling and sharing material non-public information among different parties during M&A deals. The study suggests that "...Despite the development of systems that allow access to M&A information to be heavily restricted and monitored, accidents are still seen as a potential source of leaks. For example a partner from a French law firm is quoted as saying, 'certainly, leaks happen accidentally too - we are still not in a world where there is complete security with no chance of leaks. It is human nature to make accidents and the possibility is even higher when there are too many people involved.' This view is also supported in a quote by a Partner from an Italian law firm, 'When the bidder involves many consultants, financial advisors, law firms or auditors there are several dozens of people involved who are aware of the situation and therefore the risk of accidental leaks grows in a very significant way'... Finally, a partner in a US law firm points to the importance of keeping deal information constrained to a limited number of people. 'Speaking as a lawyer you can of course have contractual arrangements that would hold you harmless or close to harmless but in reality the best way to keep leaks down is to involve as few people as possible'..."

[Insert Table IX]

Since many M&A deals have external parties involved, we focus our attention on deals where we can measure the degree to which the external parties are involved such as the number of target or acquirer advisors and/or whether the deal was externally financed (and how) or not. In particular, we construct a logit regression model as follows:

$$\begin{aligned}
 \text{Abv. Median} = & \beta_0 + \beta_1 \text{Number of Target Advisors} + \beta_2 \text{Number of Acquirer Advisors} \\
 & + \beta_3 \text{Challenging Deals Dummy} + \beta_4 \text{Related Deals Dummy} \\
 & + \beta_5 \text{External Financing Dummy} + \text{Controls} + \varepsilon
 \end{aligned} \tag{6}$$

As before, our dependent variable in these regressions is based on short term hedge fund holdings in the targets, split into above the median and below the median holdings, with the notion that greater short term hedge fund holdings are associated with an enhanced likelihood of an inside information leakage. The number of target (acquirer) advisors is the sum of financial and legal advisors for a M&A target (acquirer). In addition, our data allow us to distinguish the deals by the source of financing. Previous literature, such as Massoud, Nandy, Saunders and Song (2011), document that banks are less likely to leak material non-public information of borrowers. We, therefore define the external financing dummy equal to one, if a deal is not financed by internal corporate funds or a line of credit of the acquirer funded by a commercial bank, and zero otherwise. We also include additional control variables which are closely related to asymmetric information, such as number of block holders, lenders, analyst coverage of the target, and market capitalization. We expect to observe the intensity of short term hedge fund holdings to be higher for deals with external financing and a larger number of target (or acquirer) advisors involved in the deal.

Our results, in Table IX, show that the greater the likelihood of an insider information leakage occurring, as proxied by externally funded deals and deals with a greater number of target advisors, the greater short-term hedge fund holdings are.

4. Robustness tests

In this section, we discuss two unreported robustness tests: eliminating rumors and addressing hedge fund activism. To address the possibility that the 13F position is actually built on rumors, we manually collect any news/rumors that could be possibly related to any M&A event for either target or acquirer during the year before the public announcement of the M&A deal in our sample.³¹ We then eliminated those deals from our sample and re-ran our main tests, finding qualitatively similar results.

We then address whether short-term hedge fund holdings actively play a role in pushing firms into an M&A, as opposed to such positions being taken by hedge funds due to the leakage of inside information. We address this issue in two ways, first by removing the holdings by activists (13D filers) from our sample, and second by removing all deals from our sample that have at least one 13D filing by a hedge fund or any other financial institution in the calendar year before the announcement. In both cases we find qualitatively similar results.³²

5. Conclusion

In this paper, we investigate hedge fund trading activities in the equity and option markets prior to public announcements of M&A deals. Our measure of short-term hedge fund holdings is based on hedge fund holdings in targets in the quarter prior to the M&A deal when the same hedge fund held no stake in the target firm in the preceding year. We label these hedge funds as short-term hedge funds. We focus on these hedge funds to analyze why their holdings in

³¹ For example, we include the following case: Cognos Inc rose the most in more than five years in Nasdaq stock market trading after an analyst said it may be an acquisition target.

³² Due to space constraints, we briefly mention these robustness checks in the paper. Detailed discussion of these tests and the results are presented in the online appendix of the paper, available at: http://people.brandeis.edu/~dnandy/research_brandeis.html

target firms are so different than other hedge funds and institutional investors who generally tend to build up their holdings gradually over time prior to a M&A deal.

We find that, on average, short-term hedge funds purchase 3.2% of a target's shares in the quarter immediately prior to the public announcement of a M&A deal. Importantly, these stakes are positively related to the actual target takeover premium. In addition, we find that the level of abnormal short selling and put buying activity in the corresponding acquirer's stock is negatively related to the acquirer's stock returns following the public announcement of an M&A, especially for the high short-term hedge fund holding group.

Overall, our tests are indicative of certain short-term focused hedge funds obtaining and using material non-public (insider) information regarding takeovers prior to their public announcement. These findings raise important policy concerns regarding hedge fund trading activities and their potential regulation around M&A deals.

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Figure I: Hedge Fund Beneficial Ownership

This figure reflects the number of M&A deals with beneficial owners from 4 quarter before to 2 quarter after the public announcement, and numbers of hedge fund beneficial owners of either acquiror or target in those deals through year 2000 to 2007. M&A deals are collected through SDC and are required to have at least one 13D or 13G filing for either takeover target or acquiror by an institutional investor. The beneficial owner information is collected through the SEC EDGAR platform, and insitutions are identified as hedge funds by the various hedge fund databases mentioned in the data section.

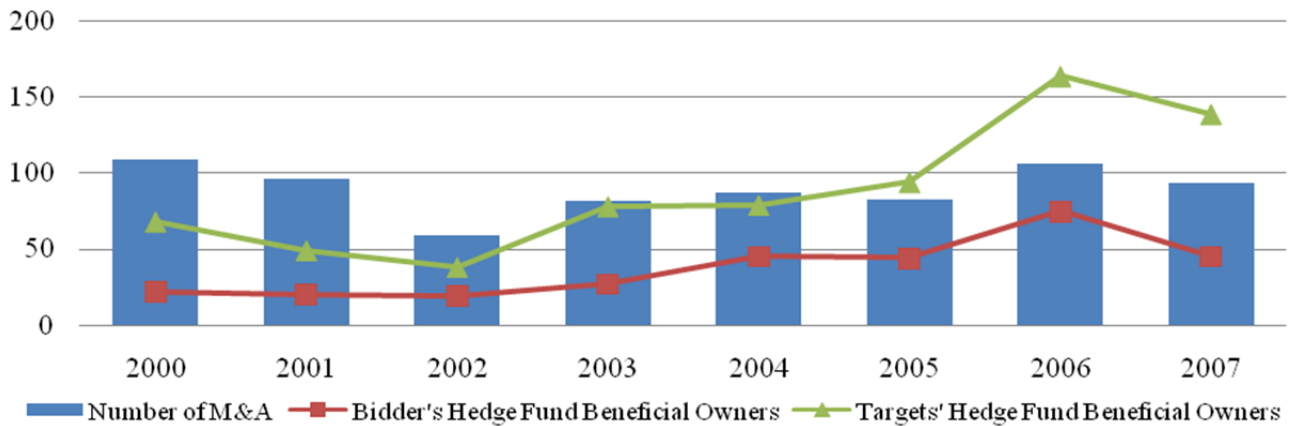


Figure II: Definition of Quarters Relative to the Announcement

Based on the nature of each filing type, we integrate our 13D, 13F and 13G ownership data on a quarterly basis. In particular, we define the quarter before the announcement as well as the days in the actual announcement quarter prior to the announcement day as quarter (-1); the days after the announcement day in the announcement quarter as quarter (0); and the remaining quarters as following the calendar quarters relative to the announcement date.

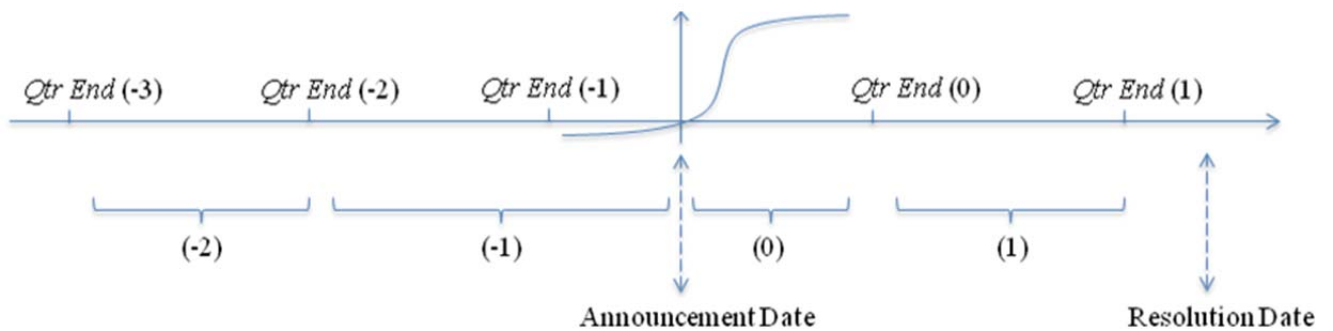


Figure III: Cumulative abnormal return around M&A announcement: Firms with high Short-Term-Hedge-Fund holdings versus firms with low Short-Term-Hedge-Fund holdings

Cumulative abnormal returns for target and acquirer firms are measured by Fama-French four-factor model (including momentum) using 255 trading day prior to -42 before the announcement date. According to their short-term hedge fund holdings, we separate our data into three groups in a given year. A target (acquirer) is considered in high short-term hedge fund holding group if its short-term hedge fund holdings are in the top group of the distribution of all takeover target (acquirer) firms in a given year. Inversely, a target (acquirer) is considered in low short-term hedge fund holding group if its short-term hedge fund holdings is in the bottom group of the distribution of all takeover target (acquirer) firms in a given year.

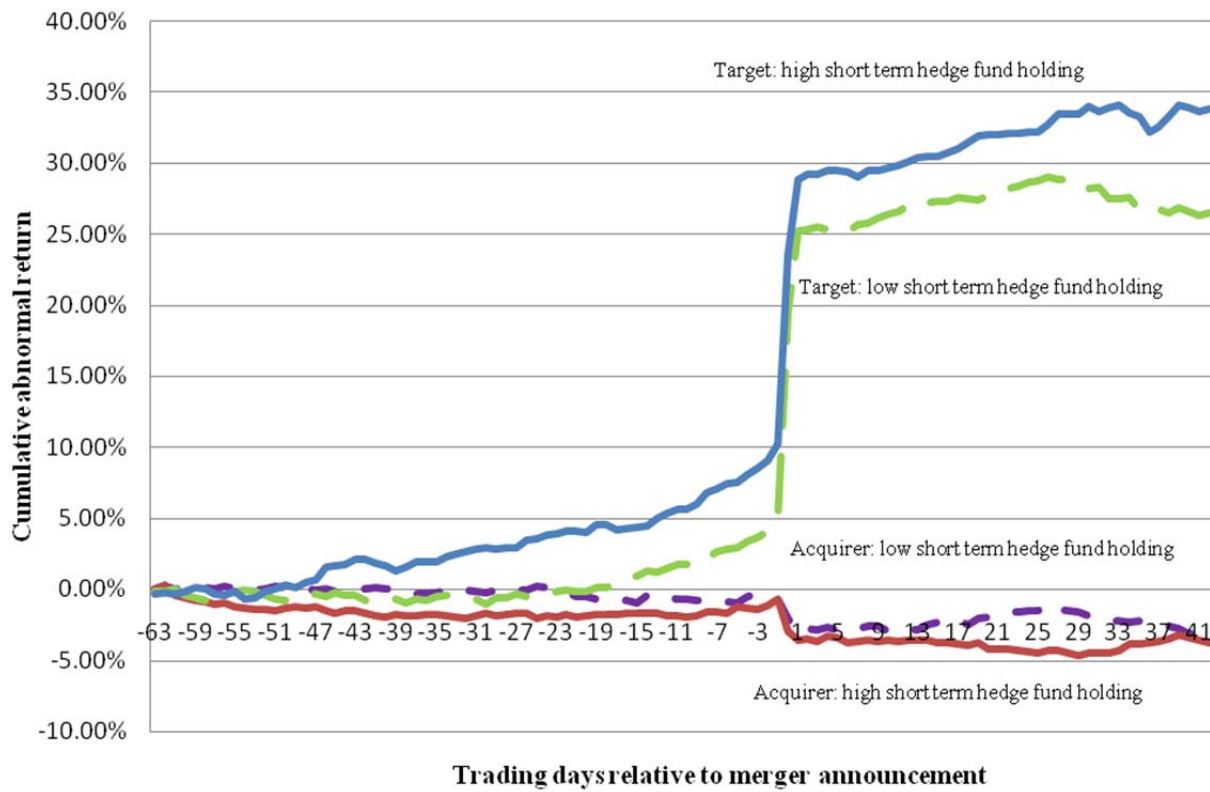
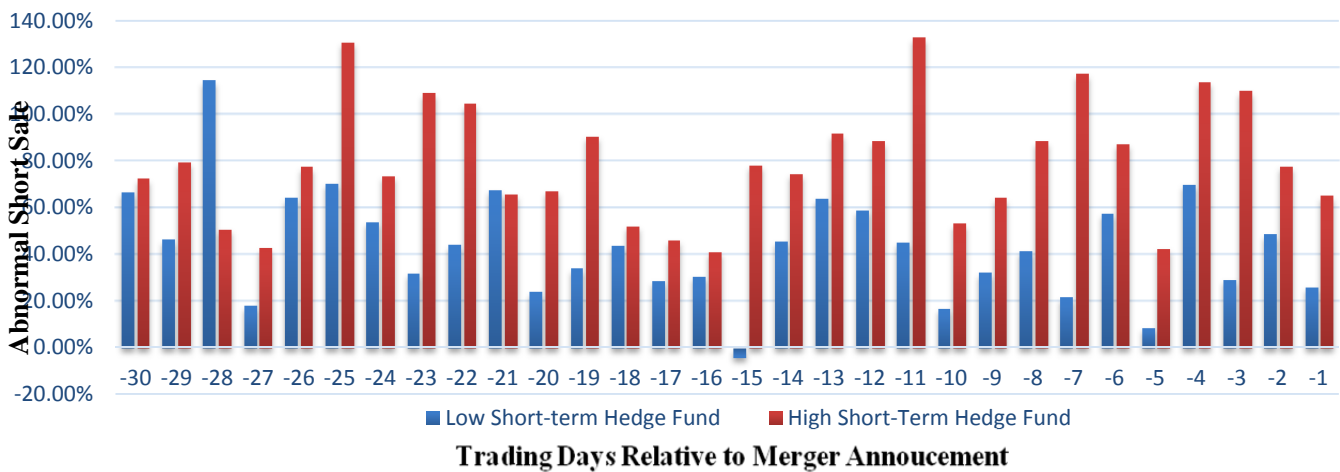


Figure IV: Acquirer Abnormal Short Selling and Net Long Put Option volume in stock Acquisitions: Firms with high Short-Term-Hedge-Fund holdings versus firms with low Short-Term-Hedge-Fund holdings

The daily abnormal short is measured as the ratio between the difference in short sale in a given day and the average short sale outside the event window (-63, 42) scaled by the average short sale outside the event window (-63, 42). The daily abnormal put option buying is measured similar to that in Poteshman (2006). Based on their short-term hedge fund holdings in target, we separate our data into three groups in a given year. An acquirer is considered in high short-term hedge fund holding group if the short-term hedge fund holdings of its target is in the top group of the distribution of all takeover target (acquirer) firms in given year. Inversely, an acquirer is considered in low short-term hedge fund holding group if the short-term hedge fund holdings of its target in the bottom group of the distribution of all takeover target (acquirer) firms in given year.

Panel A:



Panel B:

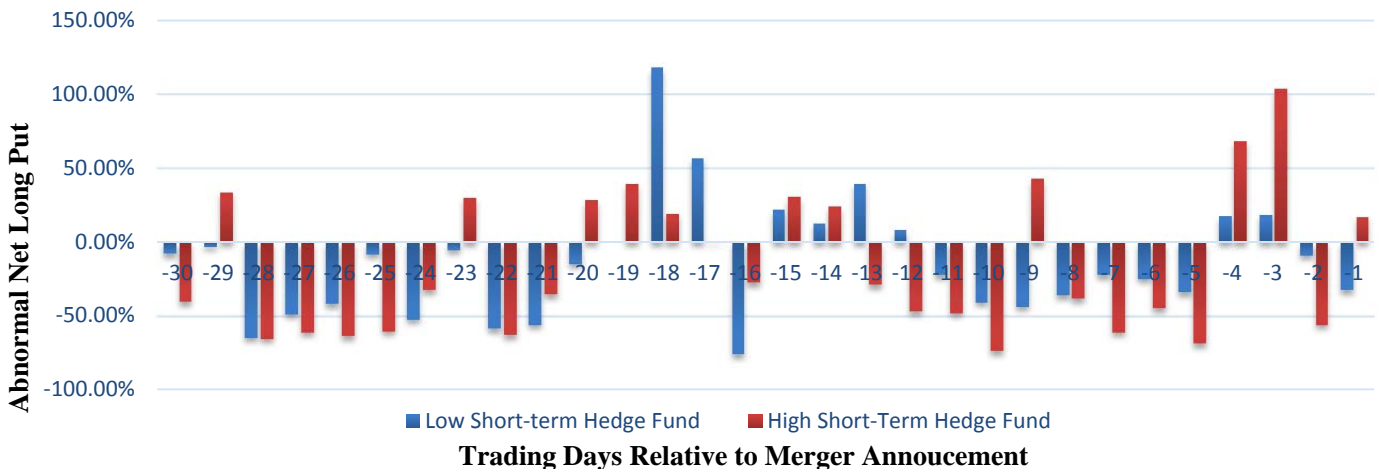


Table I: The Number of 13D/G Filing Activities of M&A Firms across Sample Period

This Table reports the number of beneficial ownership filings for our final sample of hedge funds and other institutional investors who report Schedule 13D and 13G filings as non-exempted institutional investors (13G(C)) for the M&A firms. Non-exempted owners are the hedge funds or other non-hedge fund institutional investors who file a Form 13D and/or 13G(C) for an M&A company in four quarters before and two quarters after public announcement, while activist owners are the hedge funds or other non-hedge fund institutional investors who file a Form 13D for an M&A company during the period four quarters before and two quarters after the public announcement of the deal. Panel A (B) summarizes the number of activists and non-exempted owner of M&A acquirer (target) firms in each of sample year.

Year	Number of M&A Transactions	Hedge Fund Activist Owners	Other Institutional Activist Owners	Hedge Fund Non-Exempted Owners	Other Institutional Non-Exempted Owners
<i>Panel A: M&A Acquirer</i>					
2000	109	8	36	22	54
2001	96	7	33	20	56
2002	59	4	19	19	32
2003	82	15	17	27	31
2004	87	18	19	45	38
2005	83	15	16	44	28
2006	106	15	16	75	32
2007	94	13	19	45	34
Total	716	95	175	297	305
<i>Panel B: M&A Target</i>					
2000	109	40	40	68	45
2001	96	32	35	49	49
2002	59	17	19	38	26
2003	82	45	22	78	42
2004	87	37	40	79	59
2005	83	32	19	94	37
2006	106	61	26	164	52
2007	94	58	31	139	51
Total	716	322	232	709	361

TABLE II: Short-Term-Hedge-Fund Ownership in Target Firms after Propensity Score Matching

This Table reports the characteristics of firms during the sample period from 2000 to 2007 that are propensity score matched to targets with short term hedge fund holdings. We conduct propensity score matching (PSM) based on the logistic regression of the probability of becoming a target using model (3) in Panel (A) within a nearest neighbourhood of 0.1 caliper. After PSM, we have 1094 observations in each of the treatment (actual target) and the matched sample (potential target) after removing M&As without either completion or withdrawal dates. Panel (B) summarizes the actual and potential target companies' characteristics. Panels (C) and (D) report the difference between the hedge fund holdings in the treatment and matched firms, with Panel C reporting both long and short-term and Panel D reporting only short-term hedge fund holdings. *Market capitalization* is defined as $\log(1 + \text{price} \times \text{number of shares outstanding})$ using the closing price 46 trading days prior to announcement. *Return on Equity* (ROE) is the ratio of earnings to average equity, defined as $(\text{COMPUSTAT items data20}/(\text{data60} + \text{data60}(t - 1))/2)$. *Market to Book* (M/B) is the market-to-book ratio, defined as $(\text{COMPUSTAT items 9}/60)$. *Growth of sales* (Growth) is the log of current annual sales scaled by previous year sales, defined as $(\log(1 + \text{COMPUSTAT items data12}/\text{data12}(t - 1)))$. *Accounting liquidity* (Liquidity) is the ratio of net liquid assets to total assets, defined as $(\text{COMPUSTAT items } (\text{data4} - \text{data5})/\text{data6})$. *Price to Earnings* (P/E) is the ratio of the year-end stock price to earnings per share, defined as $(\text{COMPUSTAT items data24}/\text{data58})$. *Debt to Equity* (D/E) is the ratio of debt to equity, defined as $(\text{COMPUSTAT items data9}/\text{data60})$. *Herfindahl-Hirschman index* (HHI) is calculated using industry sales data (COMPUSTAT item data12). *Buy-and-Hold* is defined as the stock return in the 255 trading days prior to the end of the fiscal year end prior to treatment announcement. Market Liquidity (*Amihud*) is the Amihud (2002) illiquidity measure, defined as the average (using daily data) of $1000 \sqrt{|\text{Return}|/(\text{Dollar Trading Volume})}$ half year prior to the end of the previous year.

	Panel(A): Probability of Becoming a Target						Panel(B): Propensity score matching							
	Model (1)		Model(2)		Model(3)		Treatment		Match		Difference			
	Est.	t-stat.	Est.	t-stat.	Est.	t-stat.	Mean	Std.	Mean	Std.	Mean	Std.		
Institutional Holding	0.95	2.60 ***	1.20	7.30 ***	1.25	7.56 ***	42.77%	30.56%	42.30%	30.68%	0.46%	23.43%		
Market Capitalization	-0.10	-4.68 ***	-0.09	-4.11 ***	-0.09	-4.36 ***	19.29	1.80	19.21	1.90	0.08	2.24		
Return on Equity (ROE)	0.11	0.58	0.10	0.79	0.09	0.80	0.03	0.35	0.02	0.45	0.02	0.45		
Sale Growth	0.07	2.10 **	0.07	3.40 ***	0.08	3.55 ***	0.55	1.21	0.52	1.26	0.03	1.49		
Accounting Liquidity	0.62	2.99 ***	0.61	4.82 ***	0.61	4.94 ***	0.27	0.23	0.27	0.23	0.00	0.24		
Debt to equity ratio (D/E)	0.06	1.61	0.06	3.19 ***	0.05	2.68 ***	0.82	1.49	0.86	1.63	-0.04	1.94		
Market to Book Ratio (M/B)	-0.04	-0.52	-0.13	-1.97 **	-0.11	-1.78 *	1.18	0.56	1.19	0.59	-0.01	0.71		
Price-Earnings ratio (P/E)	0.00	-0.24	0.00	-0.64	0.00	-0.53	12.31	47.30	9.29	40.95	3.01	62.19		
Herfindahl on Sale	-1.89	-3.46 ***	-1.23	-2.47 **	-1.28	-2.51 **	0.18	0.16	0.17	0.15	0.00	0.16		
Buy-and-Hold	-0.02	-0.51	0.01	0.80	0.00	-0.08	-0.01	0.70	-0.05	0.80	0.04	0.97		
Amihud Illiquidity	-0.18	-2.82 ***	-0.21	-3.86 ***	-0.20	-3.64 ***	0.44	0.67	0.47	0.74	-0.03	0.75		
Year	Yes			Yes										
Industry				Yes										
Pseudo R-Square	0.042		0.055		0.073									
Number of Cases	59128		59044		59044		1094		1094		1094			
	Panel(C): Hedge fund holding in Target						Panel(D): Short-term hedge fund holding in Target							
Quarters Relative to M&A Announcement	Treatment		Match		Difference		Treatment		Match		Deference			
	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.		
<i>qtr(-4)</i>	12.36%	13.49%	10.35%	10.71%	2.78%	13.74%	***							
<i>qtr(-3)</i>	12.82%	13.11%	11.03%	11.17%	2.29%	13.40%	***							
<i>qtr(-2)</i>	13.67%	13.02%	11.55%	11.60%	2.78%	13.64%	***							
<i>qtr(-1)</i>	15.77%	16.01%	12.01%	12.20%	4.37%	16.52%	***	3.19%	6.82%	1.74%	3.80%	1.41%	7.48%	***
<i>qtr(0)</i>	19.43%	17.09%	12.23%	12.04%	7.89%	16.18%	***	1.65%	3.74%	1.19%	2.65%	0.47%	4.48%	***
<i>qtr(1)</i>	13.92%	17.28%	12.28%	12.58%	1.62%	19.60%	**	1.06%	3.00%	1.01%	2.58%	0.01%	3.83%	
Obs.	1094						927							

TABLE III: Summary Statistics of Deal Characteristics by Short-Term-Hedge-Fund and Non-Hedge Fund Holdings

This Table reports deal characteristics by short-term hedge fund and non-hedge fund holdings. A short-term investor in a takeover is a financial organization or individual who does not maintain a long-term relationship but establishes the long position of target in an M&A shortly before the public announcement. We divide the short-term investors into hedge fund or non-hedge fund category, depending on whether their names are in our hedge fund database. *Target Premium* is constructed as the Fama-French four-factor (including momentum) compounded cumulative abnormal return on the target's stock from three months (63 trading day) before the bid announcement to two months (42 trading day) after the deal announcement or resolution date, whichever comes first. *Acquirer Run-up return* is defined as the Fama-French four-factor compounded cumulative abnormal return of acquirer in the previous month (21 trading day) to public announcement. *Acquirer Mark-up return* is defined as the Fama & French four-factor compounded cumulative abnormal return of acquirer in the two months (42 trading day) after the public announcement. *Risk arbitrageurs return* is constructed by following Hsieh, and Walkling (2005). The arbitrageur return of cash deal is defined as $R_t = (P_{i,t}^T + D_{i,t}^T) / P_{i,t-1}^T - 1 - r_{f,t}$ where superscript T stands for target. The arbitrageur return of stock deal is defined as $R_t = [(P_{i,t}^A + D_{i,t}^A) / P_{i,t-1}^A - 1 - r_{f,t}] - \delta (P_{i,t-1}^A / P_{i,t-1}^T) [(P_{i,t}^A + D_{i,t}^A) / P_{i,t-1}^A - 1 - r_{f,t}]$, where superscript A stands for acquirer, δ is the hedge ratio, and r_f is the risk free rate. An acquirer's Abnormal short selling during 10 or 5 trading days prior to the M&A announcement, is measured based on the approach proposed by Christophe, Ferri, and Angel (2004). The *Abnormal put option buying* is defined similar to that in Poteshman (2006). *Duration* is measured by the calendar days between the announcement date and deal effective or withdrawal date. Our approach in measuring acquirer's Abnormal short selling prior to the M&A announcement is also similar to that in Christophe Ferri and Angel (2004). We test the difference between the subgroup in means and medians using the two-sided t-test and the Wilcoxon rank sum test. (***) , (**) and (*) indicate significance at 1% , 5% , and 10% levels, respectively.

	Split of Median of Short-term Investors									
	Hedge Funds				None Hedge Funds					
	All	< Median	≥ Median	Difference	All	< Median	≥ Median	Difference		
	(1)	(2)	(3)	(3)-(2)	(4)	(5)	(6)	(6)-(5)		
Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean			
[Median]	[Median]	[Median]	[Median]	[Median]	[Median]	[Median]	[Median]			
<i>Panel A: All M&A in Regulation SHO Period</i>										
Target Premium (-63, 42)	25.73%	20.09%	31.37%	11.29%	***	25.96%	25.33%	26.59%	1.25%	
	[23.47%]	[19.96%]	[26.57%]	[6.60%]	***	[23.17%]	[21.98%]	[23.54%]	[1.56%]	
Target Run Up (-63, -1)	4.91%	2.28%	7.53%	5.25%	**	4.82%	4.78%	4.86%	0.08%	
	[3.71%]	[2.82%]	[4.80%]	[1.98%]	**	[3.59%]	[2.73%]	[4.47%]	[1.75%]	
Acquirer Run Up (-22, -1)	0.08%	-0.50%	0.66%	1.16%		-0.04%	-0.09%	0.01%	0.10%	
	[-0.79%]	[-0.71%]	[-0.90%]	[-0.20%]		[-0.86%]	[-0.97%]	[-0.78%]	[0.18%]	
Acquirer Mark Up (0, 42)	-2.70%	-3.07%	-2.33%	0.74%		-2.33%	-2.04%	-2.62%	-0.58%	
	[-2.95%]	[-2.97%]	[-2.78%]	[0.19%]		[-2.75%]	[-2.99%]	[-2.00%]	[0.99%]	
Risk Arbitrage Return (1, 42)	22.66%	21.95%	23.35%	1.41%		22.51%	22.95%	22.09%	-0.86%	
	[20.64%]	[20.63%]	[21.16%]	[0.53%]		[20.64%]	[20.72%]	[20.10%]	[-0.62%]	
Duration	128.22	134.76	121.69	-13.07		128.05	134.85	121.28	-13.57	
	[109.00]	[114.00]	[101.50]	[-12.50]	**	[113.00]	[124.50]	[100.00]	[-24.50]	***
Deal status (success rate)	87.85%	92.36%	83.33%	-9.03%	**	87.70%	89.87%	85.53%	-4.34%	
	[100%]	[100%]	[100%]	[0.00%]	***	[100%]	[100%]	[100%]	[0.00%]	
Abnormal Short Sale (-5, -1)	40.17%	38.65%	41.68%	3.03%		43.83%	39.23%	48.49%	9.25%	
	[6.66%]	[0.32%]	[8.74%]	[8.42%]		[7.43%]	[4.83%]	[10.18%]	[5.35%]	
Abnormal Short Sale (-10, -1)	39.34%	37.27%	41.40%	4.13%		41.84%	38.00%	45.73%	7.73%	
	[12.25%]	[8.53%]	[17.54%]	[9.01%]		[12.92%]	[12.92%]	[13.60%]	[0.68%]	
Abnormal Put Buying (-5, -1)	0.32%	5.09%	-4.11%	-9.20%		-0.16%	-0.34%	-0.01%	0.33%	
	[5.04%]	[4.89%]	[5.13%]	[0.24%]		[4.90%]	[5.13%]	[4.55%]	[-0.57%]	
Abnormal Put Buying (-10, -1)	2.48%	7.97%	-2.63%	-10.59%		2.22%	4.92%	-0.06%	-4.97%	
	[3.80%]	[7.21%]	[-0.14%]	[-7.35%]	*	[3.80%]	[3.41%]	[4.16%]	[0.76%]	
Abnormal Call Buying (-42, -1)	12.38%	5.77%	19.17%	13.40%		7.50%	9.51%	5.49%	-4.02%	
	[4.21%]	[2.58%]	[8.61%]	[6.03%]	**	[8.00%]	[9.52%]	[7.26%]	[-2.26%]	
Abnormal Call Buying (-63, -1)	8.72%	4.94%	12.60%	7.66%	*	8.16%	4.53%	11.79%	7.26%	
	[3.55%]	[1.05%]	[5.01%]	[3.96%]	***	[2.82%]	[5.01%]	[1.26%]	[-3.75%]	
<i>Panel B: All Stock Payment M&A in Regulation SHO Period</i>										
Target Premium (-63, 42)	23.75%	10.78%	36.38%	25.60%	***	23.61%	18.88%	28.35%	9.47%	
	[19.82%]	[13.07%]	[28.24%]	[15.18%]	***	[17.02%]	[14.65%]	[22.32%]	[7.67%]	
Target Run Up (-63, -1)	3.82%	-0.89%	8.40%	9.29%		4.75%	3.16%	6.34%	3.18%	
	[3.44%]	[3.82%]	[2.89%]	[-0.94%]		[3.95%]	[3.45%]	[6.18%]	[2.73%]	
Acquirer Run Up (-22, -1)	1.35%	2.78%	-0.05%	-2.83%		1.05%	0.15%	1.96%	1.81%	
	[0.42%]	[1.46%]	[-1.60%]	[-3.06%]	**	[0.24%]	[-1.10%]	[1.90%]	[3.01%]	*
Acquirer Mark Up (0, 42)	-5.08%	-9.48%	-0.79%	8.69%	**	-4.41%	-5.25%	-3.57%	1.68%	
	[-3.94%]	[-7.04%]	[-0.11%]	[6.93%]	***	[-3.96%]	[-4.57%]	[-2.64%]	[1.93%]	
Risk Arbitrage Return (1, 42)	20.93%	18.67%	23.19%	4.51%		19.06%	18.40%	19.73%	1.33%	
	[21.66%]	[21.37%]	[21.94%]	[0.56%]		[20.04%]	[19.19%]	[21.37%]	[2.18%]	
Duration	151.60	149.97	153.18	3.21		148.12	143.83	152.40	8.57	
	[141.00]	[144.00]	[136.00]	[-8.00]		[139.50]	[134.50]	[141.00]	[6.50]	
Deal status (success rate)	89.33%	91.89%	86.84%	-5.05%		88.10%	92.86%	83.33%	-9.52%	
	[100%]	[100%]	[100%]	[0.00%]		[100%]	[100%]	[100%]	[0.00%]	*
Abnormal Short Sale (-5, -1)	52.37%	23.16%	80.78%	57.62%	**	55.73%	50.94%	60.64%	9.70%	
	[14.96%]	[-4.18%]	[60.73%]	[64.91%]	***	[16.54%]	[16.54%]	[29.52%]	[12.98%]	
Abnormal Short Sale (-10, -1)	51.72%	23.48%	79.19%	55.71%	**	52.27%	52.54%	51.99%	-0.55%	
	[26.23%]	[4.48%]	[49.12%]	[44.64%]	***	[26.23%]	[24.23%]	[33.40%]	[9.17%]	
Abnormal Put Buying (-5, -1)	1.55%	0.30%	2.91%	2.60%		0.14%	-19.01%	15.33%	34.34%	*
	[5.14%]	[3.97%]	[5.34%]	[1.37%]		[5.14%]	[8.34%]	[4.94%]	[-3.40%]	
Abnormal Put Buying (-10, -1)	-1.99%	-4.09%	0.29%	4.38%		-3.72%	-12.82%	3.50%	16.32%	
	[2.58%]	[3.41%]	[1.75%]	[-1.66%]		[1.61%]	[-1.11%]	[5.43%]	[6.53%]	

Table IV: Target premium and Abnormal Profit from Shorting: double sorting on Short Selling and Short Term Hedge Fund Holdings

This Table consists of all completed and withdrawn M&A deals with positive short-term hedge fund holdings during the period January 3, 2005–July 6th, 2007. We first sort all the deals into above median and below median groups based short-term hedge fund holdings in the quarter prior to the M&A announcement. Deals within each group are then assigned to above median and below median classes based on abnormal short sales 10 days prior to the announcement. We report the cross-sectional averages for firms in the Low-Low (below median class for both abnormal short selling and short-term hedge fund holding subsamples) and in the High-High (above median class for both abnormal short selling and short-term hedge fund holding subsamples) groups. The target premium is measured by the Fama-French four-factor compounded cumulative abnormal return on the target’s stock from three months (63 trading day) before the bid announcement to two months (42 trading day) after the deal announcement or resolution date, whichever comes first. The Abnormal Short Sale(-10,-1) is the average daily abnormal short sales for stock in the pre-announcement period, measured as the average daily short sale from day -10 to -1 divided by the average daily short sale in the non-announcement period, all minus one. CARs are measured by using market model with an estimation window of 255 days up to 63 days prior to announcement. A Total Return is measured by subtracting an acquirer CAR from its target premium over the same event window. Abnormal Profits from shorting acquirer’s shares are measured by the average daily dollar profit from closing the preannouncement daily abnormal amount of shares sold short for each acquirer in the days after the announcement. We measure the abnormal profit from shorting acquirer’s shares by aggregating abnormal volume of short selling acquirer’s shares during the window (-10, -1) or (-5,-1) then taking the average of the potential profits that can be earned from closing the positions on any day during the window (0, 10) or (0, 5). In Particular, Abnormal Profit from shorting acquirers shares during (-10,+10) = Mean(Abnormal short sale₋₁₀ *(Price₋₁₀-Price₁) + Abnormal short sale₋₁₀ *(Price₋₁₀-Price₂) + ... + Abnormal short sale₋₁₀ *(Price₋₁₀-Price₁₀)). We test the difference between the subgroup of ownership in means and medians using the two-sided t-test and the Wilcoxon rank sum test. (***) , (**) and (*) indicate significance at 1%, 5%, and 10% levels.

	All Deals			Stock Deals		
	Low-Low	High-High		Low-Low	High-High	
<i>Panel A: Company Performance Measures</i>						
Abnormal Short Sale (Acquirer) (-10, -1)	-39.34%	105.73%	***	-37.06%	161.08%	***
	[-37.86%]	[76.49%]	***	[-31.91%]	[119.41%]	***
Short Term HF Holdings (Targets) Qtr(-1)	1.29%	11.70%	***	0.97%	7.92%	***
	[1.25%]	[6.77%]	***	[0.73%]	[5.66%]	***
Target Premium	14.98%	32.62%	***	8.17%	36.06%	**
	[15.02%]	[26.95%]	***	[10.31%]	[29.44%]	**
Total Return (-10,10)	16.74%	24.56%	**	16.48%	25.40%	
	[15.85%]	[22.18%]	**	[19.15%]	[22.54%]	
Total Return (-5,5)	16.55%	22.16%	**	18.34%	22.74%	
	[16.34%]	[21.23%]	*	[20.76%]	[20.96%]	
Abnormal Profit from Shorting (Acquirers) (-10,10)	-31,408	-31,394		-409,138	67,100	**
	[-7,670]	[938]	*	[-162,810]	[23,525]	***
Abnormal Profit from Shorting (Acquirers) (-5,5)	-23,377	-88,388		-385,784	115,928	***
	[-12,256]	[1,081]		[-118,786]	[13,354]	***
Number of Obs.	68	70		18	19	
<i>Panel B: Hedge Fund Performance Measures</i>						
Market Adjusted Return over 2 Previous Years	0.027	0.009		0.010	-0.012	
	[-0.013]	[-0.007]		[-0.038]	[-0.005]	
Market Adjusted Return over 5 Previous Years	0.127	0.091		0.044	-0.011	
	[-0.034]	[0.084]		[0.010]	[0.016]	
7-Factor Alpha over 2 Previous Year	4.251	4.747		4.997	5.695	
	[3.659]	[4.114]		[3.254]	[4.581]	
7-Factor Alpha over 5 Previous Year	1.704	1.997		3.251	2.270	
	[1.686]	[1.884]		[1.482]	[2.181]	
Number of Obs.	52	59		12	15	

Table V: Persistence in Short-Term Hedge Fund Predictability

We first sort all short-term hedge funds in each quarter by the number of M&A deals that a hedge fund participated in a calendar year prior to the quarter. We then examine target premium, run-up, and other statistics between the deals that are participated by the hedge funds in the top 90th, 95th and 99th percentile and the rests respectively. The target premium, run-up and mark-up are measured in the way described in table IV. The CARS of acquirer are calculated by market model. We test the difference between the two subgroups in means using the two-sided t-test. (***) (** and *) indicate significance at 1%, 5%, and 10% levels.

Panel A: All M&A Deals Starting from 2001

	All	<P90	>=P90	Diff		<P95	>=P95	Diff	<P99	>=P99	Diff
Target Premium	24.69%	26.38%	22.91%	-3.47%		24.53%	25.07%	0.53%	24.06%	29.52%	5.46%
	[21.89%]	[24.55%]	[18.63%]	[-5.92%]	***	[22.53%]	[20.02%]	[-2.51%]	[21.75%]	[24.60%]	[2.85%]
Target Markup	18.35%	18.86%	17.81%	-1.06%		18.34%	18.38%	0.04%	18.25%	19.07%	0.81%
	[15.55%]	[16.18%]	[14.29%]	[-1.89%]		[15.52%]	[15.89%]	[0.37%]	[15.41%]	[19.91%]	[4.50%]
Target Runnup	4.64%	5.68%	3.56%	-2.12%		4.71%	4.49%	-0.23%	4.09%	8.83%	4.73%
	[2.96%]	[2.86%]	[3.19%]	[0.33%]		[2.73%]	[4.73%]	[2.01%]	[2.83%]	[5.21%]	[2.38%]
Obs	645	331	314			450	195		570	75	

Panel B: All Stock Payment Deals from 2001

	All	<P90	>=P90	Diff		<P95	>=P95	Diff	<P99	>=P99	Diff
Acquirer CAR (-5, 5)	-4.67%	-4.18%	-5.32%	-1.14%		-4.22%	-6.10%	-1.88%	-4.61%	-5.33%	-0.72%
	[-4.52%]	[-4.52%]	[-4.63%]	[-0.12%]		[-4.03%]	[-5.66%]	[-1.63%]	[-4.54%]	[-3.41%]	[1.13%]
Acquirer CAR (-10, 10)	-4.20%	-3.28%	-5.42%	-2.14%		-3.68%	-5.83%	-2.14%	-4.32%	-3.00%	1.32%
	[-4.42%]	[-3.28%]	[-5.68%]	[-2.40%]		[-3.28%]	[-7.19%]	[-3.92%]	[-4.45%]	[-4.28%]	[0.17%]
Acquirer CAR (-22, -1)	0.67%	0.90%	0.37%	-0.53%		0.48%	1.26%	0.77%	0.97%	-2.34%	-3.30%
	[-0.25%]	[0.26%]	[-1.38%]	[-1.63%]		[-0.25%]	[-0.08%]	[0.17%]	[-0.17%]	[-3.17%]	[-3.00%]
Obs	214	122	92			162	52		195	19	

Table VI: Multivariate Analysis of Short-term Hedge Fund holdings and Target Premium

This table presents the results from the OLS estimations of short-term hedge fund holdings prior to public announcement. The regression model is specified as follows:

$$\begin{aligned}
 \text{Holding} = & \alpha + \beta_1 \text{Premium} + \beta_2 \text{Success} + \beta_3 \text{Markup} + \beta_4 \text{Runup} \\
 & + \mathbf{X}_{Deal\ Characters} \boldsymbol{\kappa} + \mathbf{X}_{Controls} \boldsymbol{\varphi} + \varepsilon
 \end{aligned}
 \tag{1}$$

Target premium is defined as the Fama-French four-factor compounded cumulative abnormal return on the target's stock from three months (63 trading day) before the announcement to two months (42 trading day) after the deal announcement or resolution date, whichever comes first. *Acquirer Runup* is defined as the Fama & French and momentum 4-factor compounded cumulative abnormal return on the target's stock from one month (21 trading day) before the announcement. *Acquirer Markup* is defined as acquirer's Fama & French and momentum 4-factor compounded cumulative abnormal return 42 trading day after the announcement. *Institutional Holdings in Acquirer* is an aggregated ownership of institutional investors in the acquirer in the quarter prior to the public announcement of the M&A deal. *Number of Analyst Covered* is defined by the number of analysts covered the firm one year prior to public announcement in I/B/E/S. The remaining variables are defined in Table II. White's (1980) heteroskedasticity-consistent *t*-values are in bracket below the coefficients in OLS results. (***), (**) and (*) indicate significance at 1%, 5%, and 10% levels, respectively.

OLS – Dependent Variable: Short-term Hedge Fund Holding						
	Panel (A)		Panel (B)		Panel (C)	
	Full Sample		Pre-2003 Sub		Post-2003 Sub	
	(1)	(2)	(3)	(4)	(5)	(6)
Target Premium	0.012**	0.010*	0.002	0.002	0.024***	0.021**
	[2.174]	[1.835]	[0.296]	[0.295]	[2.746]	[2.382]
Acquirer Mark Up (0, 42)	-0.026**	-0.028**	-0.013	-0.010	-0.053**	-0.060***
	[-2.427]	[-2.430]	[-1.204]	[-0.844]	[-2.434]	[-2.615]
Acquirer Run Up (-22, -1)	0.030*	0.028	0.015	0.012	0.067**	0.064**
	[1.744]	[1.642]	[0.950]	[0.731]	[2.483]	[2.330]
Success Dummy	-0.004	-0.005	0.008	0.008	-0.009	-0.009
	[-0.597]	[-0.622]	[1.099]	[1.048]	[-0.827]	[-0.755]
Deal Duration	-0.000**	-0.000***	0.000	0.000	-0.000**	-0.000**
	[-2.486]	[-2.593]	[-1.211]	[-0.729]	[-2.107]	[-2.428]
Stock Deal	-0.008**	-0.009**	-0.009*	-0.012**	-0.007	-0.008
	[-1.981]	[-2.241]	[-1.652]	[-1.998]	[-1.245]	[-1.530]
Hostile Deal	0.005	0.005	0.008	0.010	0.004	0.004
	[0.528]	[0.569]	[0.608]	[0.704]	[0.345]	[0.340]
Tender Offer	0.000	-0.001	0.005	0.005	-0.003	-0.002
	[-0.026]	[-0.077]	[0.540]	[0.446]	[-0.305]	[-0.213]
Institutional Holdings in Acquirer	0.043***	0.040***	0.043***	0.042**	0.038**	0.034*
	[3.282]	[2.841]	[2.603]	[2.479]	[2.249]	[1.907]
Market Capitalization		-0.001		0.000		-0.001
		[-1.364]		[-0.676]		[-1.377]
Herfindahl on Sale		0.031*		0.014		0.050**
		[1.911]		[0.567]		[2.253]
Market to Book Ratio (M/B)		0.000**		0.000		0.000
		[2.382]		[0.091]		[1.623]
Return on Equity (ROE)		-0.001		-0.003		0.000
		[-1.183]		[-0.443]		[-0.633]
Sale Growth		0.000		0.000		0.000
		[0.241]		[-0.532]		[0.669]
Accounting Liquidity		-0.005		0.017		-0.017
		[-0.573]		[1.326]		[-1.312]
Debt to equity ratio (D/E)		-0.001		-0.001		0.000
		[-0.802]		[-1.068]		[0.120]
Price-Earnings ratio (P/E)		0.000		0.000		0.000
		[1.181]		[-0.079]		[1.213]
Number of Analyst Covered		0.000		0.000		0.000
		[1.084]		[0.848]		[0.862]
Amihud Illiquidity		0.006		0.004		0.009
		[1.576]		[0.862]		[1.185]
Constant	0.029***	0.038**	0.019*	0.018	0.027*	0.042*
	[2.895]	[2.549]	[1.817]	[1.065]	[1.678]	[1.939]
Year Controls	Yes	Yes	Yes	Yes	Yes	Yes
Chow Test p-value					<0.019	<0.028
Number of Observations	796	796	283	283	513	513
Adjusted R ²	0.077	0.081	0.049	0.032	0.068	0.078

TABLE VII: Multivariate Analysis of Abnormal Short Sales, Abnormal Relative Short Sales, and Abnormal Put Buying Prior to M&A Announcements

$$ABS(-5, -1) = \beta_0 + \varphi_1 Holding + \varphi_2 Stock \times Holding + \beta_1 RET(-5, -1) + \beta_2 ABVOL(-5, -1) + \varepsilon \quad (2)$$

$$ABLongPut(-5, -1) = \delta_0 + \varphi_1 Holding + \varphi_2 Stock \times Holding + \delta_1 RET(-5, -1) + \delta_2 ABVOL(-5, -1) + \delta_3 ABOPTVOL(-5, -1) + \varepsilon \quad (3)$$

This table presents the results of OLS estimation of above equations. *Holding* is the short-term hedge fund holding of target one quarter prior to the announcement. The variable *ABS(-5,-1)* is the average daily abnormal short sales for stock in the pre-announcement period, measured as the average daily abnormal short sale from day -5 to -1 divided by the average daily short sale in the non-announcement period, all minus one. The variable *RELSS(-5, -1)* is the ratio of daily shorted shares to traded volume in the stock from day -5 to -1 period. The variable *ABLongPut(-5,-1)* is the average daily abnormal put option buying for acquirer in pre-announcement period, measured as the average abnormal put buying of acquirer from day -5 to -1. The variable *RET(-5, -1)* is the stock's return before the M&A announcement and measured from the closing price on day -6 to -1. The variable *ABVOL(-5, -1)* is the stock's abnormal volume in the preannouncement period, measured as the difference between the average daily volume in the pre-announcement period and the average daily volume in the non-announcement window (-266, -11), scaled by the average daily volume in the non-announcement window (-266, -11). The variable *NORMRELSS* is the ratio of shorted shares to traded shares in the non-announcement period. *ABOPTVOL(-5,-1)* is the average daily abnormal net option volume in the stock over the interval of day -5 to -1 (i.e., it is the average abnormal net option open interest of the put and call). White's (1980) heteroskedasticity-consistent *t* -values are reported in brackets below the coefficients. (***), (**) and (*) indicate significance at 1%, 5%, and 10% levels, respectively.

	Equation 2		Equation 3	
	Regression (1)	Regression (2)	Regression (3)	Regression (4)
	Reg. SHO	Prior to 2003	Post to 2003	Reg. SHO
<i> Holding </i>	-0.285 [-0.27]	-0.838 [-0.79]	-1.03 [-1.40]	-1.665* [-1.71]
<i> Stock×Holding </i>	4.003** [2.17]	0.483 [0.14]	1.850** [2.37]	2.057* [1.76]
<i> RET(-5,-1) </i>	1.189 [0.55]	1.167 [0.68]	-2.028*** [-2.66]	-2.777* [-1.86]
<i> ABOVL(-5,-1) </i>	0.048*** [3.16]	0.005 [0.22]	0.000 [0.01]	0.007 [0.37]
<i> ABOPTVOL(-5,-1) </i>	--- ---	0.000* [1.92]	0.000*** [5.40]	0.000*** [4.64]
<i> Constant </i>	0.432*** [5.1]	-0.006 [-0.02]	0.017 [0.42]	0.086 [1.30]
<i> N </i>	277	209	401	221
<i> Adj. R² </i>	0.057	-0.017	0.29	0.295

TABLE VIII: Relationship between abnormal short selling (put buying) and post-announcement stock returns

$$ABS(-5, -1) = \beta_0 + \beta_1 RET(0, +1) + \beta_2 RET(0, +1) + \beta_3 RET(-5, -1) + \beta_4 ABVOL(-5, -1) + \varepsilon \quad (4)$$

$$ABLongPut(-5, -1) = \delta_0 + \delta_1 RET(0, +1) + \delta_2 RET(0, +1) + \delta_3 RET(-5, -1) + \delta_4 ABVOL(-5, -1) + \delta_5 ABOPTVOL(-5, -1) + \varepsilon \quad (5)$$

This table presents the results of OLS estimation of the above equations, both for the full sample and for specific sub-samples determined by short-term hedge fund holdings. The variable $ABSS(-5,-1)$ is the average daily abnormal short sales for stock in the pre-announcement period, measured as the average daily abnormal short sale from day -5 to -1 divided by the average daily short sale in the non-announcement period, all minus one. The variable $ABLongPut(-5,-1)$ is the average daily abnormal net long put option for acquirer in pre-announcement period, measured as the average abnormal put option buying of acquirer from day -5 to -1. The variable $RET(-5, -1)$ is the stock's return before the M&A announcement and measured from the closing price on day -6 to that on day -1. The variable $ABVOL(-5, -1)$ is the stock's abnormal volume in the preannouncement period, measured as the difference between the average daily volume in the pre-announcement period and the average daily volume in window (-266, -11), scaled by the average daily volume in window (-266, -11). $ABOPTVOL(-5,-1)$ is the average daily abnormal net option volume in the stock over the interval of day -5 to -1 (i.e., it is the average abnormal net option open interest of the put and call). An acquirer is considered to be below (above) the median if the short-term hedge fund holding of its target is below (above or equal to) the median for the distribution of all takeovers in a given year. White's (1980) heteroskedasticity-consistent t -values are in bracket below the coefficients. (***) (** and *) indicate significance at 1%, 5%, and 10% levels, respectively.

Panel A: Equation (4)							
Rank by short term Hedge fund Holdings	<i>Const.</i>	<i>RET(0,1)</i>	<i>RET(0,1)</i> $\times Abv.Median$	<i>Abv.Median</i>	<i>RET(-5,-1)</i>	<i>ABVOL(-5,-1)</i>	<i>Adj. R²</i>
All	0.451***	-0.727			1.331	0.048***	0.049
[n=277]	[7.026]	[-0.851]			[0.623]	[3.136]	
All	0.486***	1.156	-3.464**	-0.04	1.264	0.049***	0.052
[n=277]	[4.916]	[0.883]	[-1.971]	[-0.325]	[0.592]	[3.307]	
\geq Median	0.462***	-2.506**			-1.442	0.057***	0.067
[n=146]	[5.456]	[-2.229]			[-0.666]	[3.370]	
< Median	0.451***	1.127			4.737	0.039**	0.065
[n=131]	[4.448]	[0.833]			[1.302]	[2.168]	

Panel B: Equation (5)								
Rank by short term Hedge fund Holdings	Const.	RET(0,1)	RET(0,1) ×Abv.Median	Abv.Median	RET(-5,-1)	ABVOL(-5,-1)	ABOPTVOL(-5,-1)	Adj. R ²
<i>All Sample in Regulation SHO Period</i>								
All [n=221]	-0.07 [-1.240]	-1.580** [-2.049]			-2.522* [-1.753]	0.000 [-0.008]	0.000*** [4.419]	0.280
All [n=221]	0.046 [0.866]	0.204 [0.283]	-3.506** [-2.389]	-2.582* [-1.815]	-0.196* [-1.946]	0.001 [0.076]	0.000*** [4.459]	0.289
≥ Median [n=114]	-0.194** [-1.994]	-3.259** [-2.034]			-3.401 [-1.240]	-0.005 [-0.144]	0.000** [2.580]	0.234
< Median [n=107]	0.06 [1.213]	0.064 [0.090]			-1.175 [-1.353]	0.004 [0.278]	0.000*** [5.341]	0.519

Panel C: Equation (4)								
Rank by short term Institutional Holdings	Const.	RET(0,1)	RET(0,1) ×Abv.Median	Abv.Median	RET(-5,-1)	ABVOL(-5,-1)	ABOPTVOL(-5,-1)	Adj. R ²
All [n=305]	0.510*** [6.923]	-0.332 [-0.360]			2.185 [0.909]	0.060*** [2.895]		0.058
All [n=305]	0.487*** [4.941]	0.026 [0.020]	-0.623 [-0.348]	0.044 [0.329]	2.17 [0.899]	0.060*** [2.900]		0.052
≥ Median [n=154]	0.544*** [5.115]	-0.659 [-0.497]			3.971 [1.025]	0.078*** [2.825]		0.064
< Median [n=151]	0.479*** [4.715]	-0.091 [-0.072]			0.057 [0.022]	0.050** [2.408]		0.046

Panel D: Equation (5)								
Rank by short term Institutional Holdings	Const.	RET(0,1)	RET(0,1) ×Abv.Median	Abv.Median	RET(-5,-1)	ABVOL(-5,-1)	ABOPTVOL(-5,-1)	Adj. R ²
<i>All Sample in Regulation SHO Period</i>								
All [n=237]	-0.068 [-1.259]	-1.536** [-2.041]			-2.433* [-1.797]	-0.001 [-0.076]	0.000*** [4.426]	0.279
All [n=237]	-0.137* [-1.860]	-2.029* [-1.881]	0.897 [0.687]	0.133 [1.319]	-2.481* [-1.831]	-0.003 [-0.175]	0.000*** [4.438]	0.277
≥ Median [n=121]	-0.03 [-0.371]	-1.105 [-1.138]			-2.589 [-1.177]	-0.019 [-0.614]	0.000*** [3.359]	0.344
< Median [n=116]	-0.12 [-1.619]	-1.750* [-1.716]			-2.103 [-1.501]	0.007 [0.366]	0.000*** [5.098]	0.160

Table IX: Insider Information Leakage and Short-Term Hedge Fund Ownership

We report the results of a logistic regression explaining the possibility that a deal would attract above median short term hedge fund ownership in a given year. Number of acquirer (target) advisors is the total number of financial and legal advisors for acquirer (target) from SDC. The external financing variable equal to one, if the sources of funding are not corp funds or line of credit in SDC, or when we find an M&A related loan for acquirer in Dealscan database (starting within one year prior, but not ending after the M&A announcement), otherwise zero. We then further restrict deals to be through internal financing, if the lead lenders of external funding are banks in Dealscan database. Number of lenders is defined as the number of distinct institutions with syndicated loans outstanding to the acquirer from Dealscan database (starting within one year prior, but not ending after the M&A announcement). Number of acquirer (target) block holders is the number of 13F reporting institutions with more than 5% shares of acquirer (target) in the second last quarter prior to the announcement according to Thomson Reuters. Target firm analyst coverage is the total number of analysts following the target firm during the second last quarter prior to the M&A announcement according to IBES. The acquirer (target) capitalization is the logged market cap of acquirer (target) 46 days prior to public announcement. We report *p*-values in parentheses below the coefficients. (***), (**) and (*) indicate significance at 1%, 5%, and 10% levels, respectively.

	<i>Prob (High Group)</i>	
	Marg. Eff.	Marg. Eff.
Number of Target Advisors	0.201*** (0.008)	0.210*** (0.009)
Number of Acquirer Advisors	-0.0380 (0.564)	-0.0284 (0.718)
External Financing (0,1)	0.621** (0.010)	0.662** (0.010)
Number of Lenders		0.0106 (0.275)
Number of Acquirer Block Holders		-0.0640 (0.419)
Number of Target Block Holders		0.117 (0.122)
Analyst Coverage (Target)		0.0374* (0.090)
Acquirer Market Cap		-0.0384 (0.644)
Target Market Cap		-0.125 (0.337)
Year Fixed Effect	Yes	Yes
OBS	390	390
pseudo R-sq	0.025	0.041