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

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Abstract

This paper investigates the recent increase in allegations regarding the misuse of insider information in M&A deals that has attracted the attention of regulatory authorities. We analyze this issue by using a unique and comprehensive hedge fund dataset which allows us to analyze the trading pattern of hedge funds around corporate mergers and acquisitions in both the equity and the derivatives markets. In general, our results are consistent with the idea of hedge funds with short-term horizons taking advantage of private information and engaging in trading based on such information. We show that short-term hedge funds take abnormally long positions on target's stock in M&A deals with high target premium in the quarter prior to the deal's announcement while having no prior stake in the firm over the preceding year. We also find evidence consistent with informed abnormal short selling and put buying in the corresponding acquirer's stock prior to M&A announcements when short-term hedge funds take larger stakes in target firms. In addition, we show that such a strategy is potentially very profitable. We consider alternative explanations for such opportunistic hedge fund holdings in target firms, but our results seem inconsistent with these alternative explanations and suggest that such holdings and trading patterns arise primarily due to exploitation of private information. Our results have important implications regarding the recent debate on hedge fund regulation.

Keywords: Hedge funds, institutional investors, merger and acquisition, long holding, short-selling, private information, and conflict of interest.

JEL Classifications: D82, G14, G30, G34

I. Introduction

Recently, there has been a marked increase in allegations regarding the misuse of insider information in mergers and takeovers which has attracted the attention of regulatory authorities and researchers. In one recent case involving the Galleon Hedge Fund, the SEC arrested over a dozen people for leaking and trading on inside information concerning some M&A deals. A number of other such instances have also been reported in the last couple of years.[1] In most of these cases, anecdotal evidence points to hedge funds being involved as one of the major participants and beneficiaries of such insider trading. However, so far, the question of whether hedge funds are widely involved in such activities has neither been established nor properly examined. Their high turnover portfolios, undiversified investment strategies, and absence of reporting requirements make hedge fund's potential illicit trading less conspicuous to market regulators; while the absence of obligated disclosure and intensive use of short selling and derivative trading strategies impede insightful investigations from researchers.[2]

In this paper, we attempt to address this issue by using a unique and comprehensive hedge fund dataset that allows us to analyze the trading pattern of hedge funds around corporate mergers and acquisitions in both equity and derivative markets. In the equity market we

[1] According to the SEC, prosecutors brought a civil suit of insider-trading against 14 defendants, including an executive at UBS and a former compliance lawyer at Morgan Stanley in March 1, 2006 at New York and Washington. This scheme included hundreds of tips which produce more than $15 million illegal profits over five years. Additionally, the SEC brought 51 hedge fund fraud cases from 2000 to 2004 and over 100 cases involving hedge funds over period from 2004 to 2009.

[2] 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

investigate the involvement of hedge funds in both long positions in targets' stock and potential short positions in acquires' shares, while in the derivatives market we examine put option trades.

It has been shown previously in the literature that insider trading not only leads to considerable profits around mergers but also imposes externality costs (such as higher premiums or lower probability of deal completion) around such events. Empirical evidence suggests that insider trading has a negative impact on deal duration and merger premiums paid, which consequently affect management's attitude and decisions.[3] 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 around $18 to an 18-month high of $24. First Federal's merger proxy said "[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."

Given the large magnitude of informed trading around takeovers, as suggested by anecdotal evidence, there is reason to believe that the primary informed traders are not individuals.[4] Among money managers, hedge funds constantly receive the most public blame whenever suspicious trading spikes are observed, partly because of their incentive fee structures, and partly because of their opaque but aggressive investment strategies which makes it easier for

[3] According to a study of global M&A over 1994-2007 (Moeller and Omiros, 2009), only 49% of leaked deals are completed, but 72% of non-leaked deals are completed. Comparing to 97% friendly deals in non-leaked takeovers, 80% of leaked deals are friendly. Leaked deals take 70% longer to complete than non-leaked deals. And the premium eventually paid in leaked deals is approximately 13% lower than for non-leaked deals.

[4] An article in the *Economist* on May 12, 2007 reports "[i]n the 17 biggest takeovers of the past year in America, options trading jumped to more than three times normal levels, on average, in the three days before the deal was made public…". Additionally, according to a 2006 study of Measuredmarkets.com for *Bloomberg*, the aberrant trading patterns (potentially insider trading) prior to the announcement of deals are 41% for US and 63% for Canadian takeovers.

them to avoid being detected by regulators.[5] As one of the largest group of institutional investors, hedge funds implement various investment strategies and styles. However, it would be injudicious to expect that every hedge fund seeks opportunities to trade on non-public material information.

To investigate whether hedge funds are involved in insider trading prior to mergers and takeovers, we focus on those hedge funds that acquire a long position in a target firm shortly before the public announcement of a proposed takeover. Specifically, we analyze those hedge funds that did not have any stake in the target firm over the prior year, but suddenly acquired a significant holding in the firm within one quarter just prior to the merger. We hypothesize that such short-term pre-announcement entry of a hedge fund as a target shareholder (henceforth **short-term hedge fund**) is primarily associated with potential access to material non-public insider information about the likelihood of a merger.

Our above strategy of identifying short-term hedge funds, is partly motivated by the recent SEC case against Galleon hedge fund and its founder Raj Rajaratnam. In the case filed by the SEC, it is alleged that Rajaratnam received insider information from a friend related to the premium that would be paid to Hilton (the target) shareholders in the impending takeover of Hilton by the Blackstone Group (which was publicly announced on July 3, 2007). Rajaratnam then proceeded to trade based on that information by taking a long position of 400,000 shares in Hilton through Galleon Tech funds, whose stated purpose was to make investments in the technology sector.[6] Thus, similar to our set-up above for identifying short-term hedge funds,

[5] 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."
[6] Galleon Tech funds ultimately sold their Hilton shares after the July 3 announcement for a profit of over $4 million.

Galleon Tech Fund did not own any position in Hilton prior to the merger but suddenly acquired a substantially long position in the target just prior to the public announcement of the deal.

Though in general, it may be difficult to identify how hedge funds might routinely acquire private information about M&A deals, anecdotal evidence suggests that short-term hedge funds obtain such information through their private connections in the industry. For example, in the Galleon case described above, 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.[7] However, if short-term hedge funds do indeed possess such insider information, then we should be able to investigate the potential usage of this information to generate abnormal profits not only from long positions held in the target's shares but also from short selling the acquirer's shares in stock deals just prior to the public announcement of M&A deals.[8]

In addition to the above motivation, in this study we focus on short-term hedge funds rather than long-term holdings in target's shares since short-term holdings are more likely to be associated with leakage of insider information about M&A deals rather than shareholder activism, active monitoring or cherry-picking of investment strategies which have been previously shown in the literature to be associated with long-term holdings by institutional investors. Specifically, using M&A decisions, Chen, Harford, and Li (2007) argue that institutional investors benefit

[7] Lhabitan (2006) suggests that the relationship between investment bankers and hedge fund has witnessed interesting developments in recent years. Recently, providing prime brokerage service to hedge funds has been considered important business to investment banks who compete hard 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.

[8] It should be noted that while this is similar to the much prevalent practise amongst hedge funds of following a "merger arbitrage" strategy, this is not exactly the same. In a pure merger arbitrage strategy hedge fund holdings and short selling increase at or after the time of the public announcement of the merger.

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 efforts. Moreover, Bodnaruk, Massa, and Simonov (2009), suggest that financial advisors 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 premium.[9]

Finally, an alternative explanation for the short-term preannouncement entry of hedge funds around takeovers could be attributed to such hedge funds having superior abilities to spot potential targets, gleaned from publicly available information. Thus, in order to benefit most from an upcoming merger, hedge funds take a long position in such targets within the quarter prior to the merger's public announcement. In our analysis in this paper, we provide a variety of different tests to rule out this alternative explanation.[10]

The analysis in this paper empirically examines three questions related to hedge fund involvement prior to takeovers. Specifically, do short-term hedge funds take advantage of material non-public information and trade on such information prior to merger announcements? First, we investigate whether the target stakes of short-term hedge funds are related to target

[9] Other papers that are also related to this paper include Christophe, Ferri, and Angel (2004), who provide empirical evidence of informed trading prior to earnings announcements. They find evidence of abnormal short-selling that is significantly associated with negative post-announcement stock returns following earnings announcements. Also, Cao, Chen, and Griffin (2005) find evidence of informed trading in options market. They show that takeover targets with the largest preannouncement call-imbalance tend to experience the highest returns at announcement. At the same time, Gaspar, Massa, and Matos (2005) show that target firms with short-term shareholders are more likely to receive an acquisition bid with lower premiums. Yan and Zhang (2009) suggest that short-term institutions are better informed by documenting that future stock returns are driven by short-term institutional investors. Finally, Poteshman (2006) provides evidence of informed trading in advance of terrorist attacks by showing an unusually high level of put buying prior to September 11, 2001.

[10] 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 private insider 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.

premiums, short selling and profitability of short selling in the acquirer's shares prior to the deal's public announcement, to acquirer mark-ups, and to other deal characteristics such as completion status and management attitudes. Using original Form 13F (171,806), SC13G (391,368), and SC13D (141,079) filings retrieved from SEC's Edgar system, we construct a comprehensive institutional holding data which includes the entire universe of hedge fund long positions available from all SEC public disclosure requirements between 1999 to 2007. Following previous papers in the hedge fund literature, such as Kosowskia, Naik and Teo (2007), Griffin and Xu (2007), and Huang (2008), we identify hedge fund holdings in this dataset by using hedge fund identities from six major hedge fund databases, including the TASS Hedge Funds Database, Hedge Fund Research, and Center for International Securities and Derivatives Markets database and SEC's Form ADV.[11] Our empirical results show that short-term hedge funds indeed make *ex ante* profitable portfolio selections, with long positions in target firms and short positions in acquiring firms, thus significantly affecting their overall profits.

The second issue we address is whether short-term hedge fund participation is associated with high levels of preannouncement short selling in the acquirer's stock? Unlike prescheduled corporate events in which some traders make speculative bets even without superior information, abnormal preannouncement short selling in takeovers is more likely to be undertaken by informed traders since M&A activities are not well anticipated corporate events in the equity markets. To investigate this, we examine the abnormal trading activity of acquirer stock in both the equity markets (short selling) and the derivative market (put buying). We employ short

[11] ADV form is a required submission to the SEC by a professional investment advisor that specifies the investment style, assets under management and key officers of the firm. The form must be updated annually and be made available as public record for companies managing in excess of $25 million.

selling data from Regulation SHO's pilot program between January 3, 2005 and July 6, 2007, and option trading data from OptionMetrics for our entire sample period.

After controlling for contemporaneous market movements, we find that target stakes of short-term hedge funds are positively related to the level of preannouncement abnormal short selling and put buying of acquirers in stock deals. This result is consistent with the notion of short-term hedge funds utilizing material non-public information in their equity trades prior to the public announcements of M&A deals. Thus, this result, along with other evidence in this paper, is suggestive of trading by hedge funds that is consistent with exploitation of insider information.

The third question we examine is whether insider trading around takeovers is more likely to have occurred when short-term hedge funds buy larger stakes of the target? Specifically, we explore the relationship between abnormal short selling activities conditioning on the high level of short-term hedge fund holdings in a target's equity and post-announcement market reaction. We find substantial evidence consistent with informed abnormal short selling and put buying in acquirer's stock prior to takeover announcements when short-term hedge funds take larger stakes in target firms.

This paper is, to the best of our knowledge, the first paper to explicitly investigate the possible role of hedge funds in exploiting private information prior to public announcements of takeovers. By employing a unique and comprehensive database, this paper complements the existing literature and makes three additional contributions. First, this is the first paper to provide evidence that is consistent with hedge fund's trading on material non-public insider information around takeovers. Second, the results also suggest that hedge funds have engaged in such trades

exploiting private information surrounding takeover announcements more frequently in recent years. Third, our empirical findings have strong implications for the recent regulatory focus of the SEC on several issues concerning potential insider trading by hedge funds prior to mergers and acquisitions.[12]

The rest of this paper is organized as follows. In Section II, we present our hypothesis. In section III, we describe our data. In Section IV we present our empirical methodology and our empirical results. Finally, Section V concludes.

II. Hypotheses

In this section we develop testable hypotheses to investigate the issues raised above relating to short-term hedge fund involvement in M&A deals. We propose three hypotheses to examine whether short-term hedge funds, i.e., hedge funds that invest in target firms in the quarter prior to the public announcement, engage in trading based on private information and implement profitable investment strategies effectively. This would imply that short term hedge funds will acquire positions in more lucrative deals, i.e., deals in which the target premiums are higher.

A common strategy for a short-term hedge fund possessing superior information is to enter into takeover deals *prior* to its public announcement, expecting to profit by buying *large* stakes in the target's stock at lower prices. Further, short-term hedge funds with access to private information could also generate additional profits from stock deals by taking *large* short positions in the acquirer's stock at higher prices *prior* to the public announcement of the deal.

[12] Elisse B. Walter, *Testimony Concerning Securities Law Enforcement in the Current Financial Crisis Before the United States House of Representatives Committee on Financial Services*, March 20, 2009, available at: http://www.sec.gov/news/testimony/2009/ts032009ebw.htm#P134_41627

In particular we will test the following three hypotheses:

- **Hypotheses 1 (H1):** *Short-term hedge funds are more likely to take abnormally long positions in targets associated with M&A deals with high target premium.*
- **Hypothesis 2 (H2):** *The acquirers in M&A deals with larger preannouncement target stakes of short-term hedge funds are more likely to be abnormally sold short in stock deals prior to public announcement.*
- **Hypotheses 3 (H3):** *Active informed trading prior to M&A announcements are more likely to be observed in takeover deals with larger preannouncement target holdings of short-term hedge funds.*

Positive support for these hypotheses would imply that short-term hedge funds engage in insider trading or possess certain pre-announcement informational advantages, and implement trading strategies that seek to maximize profits by exploiting the private information prior to the public announcement of the deal. In various tests in the paper we aim to distinguish between these two possible potential explanations.

III. Data Description

Initially, we consider all mergers deals (both completed and withdrawn) between January 1, 2000, and December 31, 2007 as identified by Securities Data Corporation (SDC) M&A database. We apply the following filters that are common in the prior M&A literature (e.g. Betton, Eckbo, and Thorburn, 2008; Gaspar, Massa, and Matos, 2005). We keep all offers where the acquirer seeks to own 100% of target shares, while excluding divestitures, spin-offs, repurchases, self-tenders, and transaction whose value represents less than 1% of the acquirer's

or target's stock market capitalization at 46 trading days prior to the announcement to ensure that the takeover has a reasonable impact on the firms involved in the deal. We then group each M&A deal into either stock, cash, or mixed payment category according to its contract terms. We require that both acquirer and target firms be available in CRSP and Compustat, allowing us to retrieve their stock market and accounting data, and that they be listed in NYSE, Amex, or Nasdaq, which leaves us with 1,271 deals. Next, we obtain analyst coverage from I/B/E/S, option trading from OptionMetrics database, and institutional holdings data from CDA/Spectrum 13F for this sample. Finally we collect the short selling data during the RegSHO period from the nine major U.S. exchanges.

To measure hedge fund holding positions in M&A transaction, we first identify hedge funds and/or hedge fund advisors. We construct a comprehensive database of hedge funds by combining seven databases used in the prior literature: 1) the TASS Hedge Funds Database (TASS), 2) Hedge Fund Research database (HFR), 3) Center for International Securities and Derivatives Markets database (CISDM), 4) *Nelson's Directory of Investment Managers* 2004 to 2006, 5) *Institutional Investor* magazine's annual Hedge Fund 100 List 2003 to 2007, 6) the database of Cottier, and 7) the Private Equity Information hedge fund database (which collects hedge fund data from the SEC's ADV forms). Each of the seven listed sources reports hedge fund and/or their advisors' names. We identify and remove duplicate hedge funds by manually checking their names and addresses. Specifically, we preserve the information from the Securities and Exchange Commission's (SEC's) Form ADV filings when the filing observations are duplicated by those from one or more of the other six sources.

Many hedge fund managing firms, especially large ones, have more than one functional area. According to *Institutional Investor* top 100 hedge fund list 2007, for example, J.P. Morgan

Asset Management is ranked as the largest hedge fund firm. However, the company also manages different investment arms other than hedge funds, such as fixed income, currency, real estate, infrastructure, and private equity, etc. Therefore it is particularly difficult to define hedge funds at fund advisory level. During our sample period, investment advisers managing assets of $25 million or more were generally required to register with the SEC and to file ADV forms until the registration requirements were overturned by the courts in June 2006.[13] Using the information on the ADV forms and following Griffin and Xu (2007) and Huang (2008), we apply the following criteria to observations from ADV forms to define a hedge fund advisor: the company charges performance-based fees and at least 50% of its clients are either "high net worth individuals" or at least 50% of its clients are in "Other pooled investment vehicles (e.g., hedge funds)".[14] After excluding duplicates and hedge fund firms that do not meet these criteria, we end up with a comprehensive hedge fund sample comprising 9,525 unique hedge fund advisory firm names and 48,601 unique fund names with detailed hedge fund information from all sources.

We then collect information of the hedge funds' holding position from three types of SEC ownership disclosure filings. Currently there are five types of such forms for large shareholders

[13] See, Brown, et. al. (2008) who provide a detailed analysis on the benefits and drawbacks of mandatory disclosure as a regulatory tool, arising due to this controversial SEC policy requiring hedge funds to register. Overall, their findings suggest that hedge funds operated by managers who filed Form ADV had better past performance and had more assets than those operated by managers who did not file. Moreover, they find a strong positive association between potential conflicts identified in the Form ADV filing and past legal and regulatory problems.

[14] It is important to note that our sample does not focus on the particular subset of hedge funds that file form ADV, since many hedge funds, particularly those that are non-U.S. domiciled did not file form ADV and many were exempt from the requirements. We simply use this form to "clean" our hedge fund data from the other sources since many of the management firms identified in TASS, HFR, or CISDM as hedge funds also have substantial operations that are not related to hedge fund activities. Thus, this issue could not be totally resolved, since the Form ADV sample does not comprise the universe of hedge funds and therefore the other six hedge fund databases may still contain hedge fund management companies with multiple functional areas, implying that we fail to remove certain management firms of investment companies from our sample with only a small hedge fund department. The presence of this random error in the data therefore would only bias against us finding significant results.

in SEC's filing universe: active beneficial ownership on Schedule 13D, passive beneficial ownership on Schedule 13G, quarterly institutional holding on Form 13F, quarterly mutual funds holdings on Forms N-1A, N-CSR, and N-Q, and insiders (directors, officers, and other 5% shareholders) under the Securities Exchange Act of 1934, § 16(b).[15] Since hedge funds are not under mutual fund regulations and 5% share holders must also report either 13G or 13D, a combination of Form 13F and Schedule 13D and 13G provides a near complete universe of SEC ownership filings for the hedge fund industry.

While, the previous literature has commonly used CDA/Spectrum data to identify equity holdings, one drawback of this approach is that only the name of the reporting entity, usually the ultimate parent company, is provided in CDA/Spectrum. This is problematic since some hedge funds report their holding jointly with its parents. By using CDA/Spectrum therefore, we will miss the holdings of such hedge funds in the 13F filings, when the parent firm is not a hedge fund.[16] Thus, in order to retrieve the name and precise ownership information for all hedge funds in our sample, we collect 171,806 original Form 13F files from SEC's Edgar database from 1999 to 2007 for 4,674 reporting entities along with the jointly reporting managers.

In addition, we also collect data on the ownership stake of beneficial owners, i.e., those owning more than 5% shares of a company. These beneficial owners need to file with the SEC a statement containing information that identifies their precise equity holdings. The passive beneficial owners that are merely investing in the ordinary course of their business file a Schedule 13G usually within 45 days after the end of the calendar year in which they exceed this

[15] All institutions with greater than $100 million of equity securities under discretionary management shall disclose their common stock positions greater than 10,000 shares or $200,000 at the end of each quarter in their Form 13F filing.

[16] For example, the original Form 13F filing of Citigroup in Dec 31st, 2007 reports 45 financial manager names, including its alternative investment funds (which are the hedge funds), while CDA/Spectrum only reports the name of reporting managers' name, Citigroup Inc, for the same quarter.

ownership threshold.[17] On the other hand, the active beneficial owners, need to report Schedule 13D within 10 days of acquiring their stakes. To collect the detail data in Schedule 13D/13G, we 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.

Consistent with the recent 13D literature (e.g. Greenwood and Schoar, 2009; Clifford, 2009), we remove all Schedule13D/A records that do not document any acquisition or change in ownership position but attach only a letter of intent or statement amendment to an issuer's management team and board members. To focus solely on the institutional investors, we further remove Schedule 13D for non-institutional investors, such as directors and officers; if the reporting entities never report Form 13F nor SC 13G as exempted institutional investors; if the SIC Code of the reporting entity does not belong between 6000 and 6999, (the SIC code of money management industry);,or if the name of the entity does not match with those in our hedge fund database[18]. Finally, we remove Schedule13D filings for tender offers and entries

[17] According to Securities Exchange Act of 1934 Rule 13d-1 & 13d-2, any active beneficial owners, who hold more than 5% of any equity security with purpose or with the effect of changing or influencing corporate control, shall file with SEC a Schedule 13D within 10 days after the acquisition. The active beneficial owners shall also file with SEC Schedule 13D amendment promptly, when they change their position of beneficial ownership of securities in an amount equal to 1% or more of the class of securities. The passive beneficial owners who has acquired more than 5% of such securities in the ordinary course of his business and will not involve in corporate decision in any form shall file with SEC a Schedule 13G. If the passive beneficial owners are qualified financial institutions such as most brokers, banks, and insurance companies, they are required to report within 45 days after the end of the calendar year in which they obtained beneficial ownership. For this group of passive beneficial owners, they shall file a Schedule 13D amendment within 10 days after the end of the first month in which the reporting entity's direct or indirect beneficial ownership exceeds 10% of the class of equity securities. If the passive beneficial owners are not exempted institutions, then need to file with SEC within 10 days after an acquisition. The non-exempted group of beneficial owners also shall file with the SEC Schedule 13G amendments promptly when they increase or decrease their beneficial ownership by more than 5% of the class of equity securities; as well as a Schedule 13D promptly when they hold greater than 10% of a class of equity securities. Under the Rule 13d, hedge funds are, therefore, mostly likely to file with the SEC Schedule 13D and 13G as non-exempted investors (13D Rule C).

[18] We also manually checked the most frequently observed activists and risk arbitrageurs that are not covered in our hedge fund database. We use "Hedge Fund" as keyword along with the reporting entity's name to search in Lexis/Nexis, Bloomberg, and Businessweek. We consider the individuals as hedge funds, if they are well-known hedge fund general partner, such as Roth Michael, and keep the hedge funds that report a similar but not exactly the same name in our hedge fund database, such as Ziff Asset Management LLP.

where Schedule1 13D is also reported as a third party tender offer statement, Form SC TO-T. We report the distribution for the Schedule 13G/13D 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. Through 2000 to 2007, there are 716 M&A transactions with at least one institutional beneficial owner for target and/or acquirer during the period from four quarters prior to two quarters after the takeover announcement. As can be seen from Figure I, there is a strong upward time trend of hedge fund beneficial ownership in our sample, especially for the target firms. Conversely, the number of other beneficial owners remains relatively unchanged. These temporal trends are consistent with the previous beneficial ownership literature. Greenwood and Schor (2009), for example, shows that annual activist filings by non hedge funds remains relatively fixed between 1996 and 2006, while hedge fund filings increase dramatically, more than half of the hedge fund activist related events occur in 2003 or later.

Finally, we integrate ownership data from three different SEC filings into one dataset. Since Schedule 13D/13G forms are filed only when the 5% threshold is breached, our data is organized quarterly by the reporting nature of Form 13F. Form 13F provides a snapshot of ownership positions at the end of each quarter. Therefore, relying on Form 13F alone would reduce the magnitude of observed trading activity in target stocks.[19] Including Schedule 13D and

[19] For example, on April 20, 2006, Sprint Nextel announced a proposal to acquire Ubiquitel for more than $1.3 billion in cash and debt. Deephaven Capital Management LLP, a hedge fund advisor, which had reported a 2.05% and 2.63% ownership position in the target in its 13Fs filed in the two quarters prior to announcement, disclosed a 9.98% beneficial ownership position exactly on the M&A announcement date in its Schedule 13G filing. Further, on May 11, 2006, the same hedge fund filed a Schedule 13D disclosing its 18.0% beneficial ownership stake in the target. During the M&A negotiation process, Deephaven got actively involved in the Sprint Nextel M&A decision, proposing, for example, a slate of nominees to the board of directors. However, when the acquisition agreement was reached on Jun 27, 2006, Deephaven did not report any ownership in Sprint Nextel in its Jun 30, 2006 Form 13F filing.

13G, therefore, provides us with an additional source to measure the amount and timing of potentially large trading activities in target firms more accurately.

We define the quarter before the announcement and the days in the announcement quarter but before 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 announcement. We then take the maximum amount of hedge fund holdings from Form 13F, Schedule 13G and 13D in each quarter as the ownership of this institutional investors holding in that quarter. Since most reporting entities are ultimate parents of other members in the cases of joint SC13D/G or 13F combination filings, we consider the aggregated amount of such filings as a hedge fund holding, if the reporting entities' names are found in our hedge fund database. When the filing entity is not identified, but some of the jointly reporting entities are identified as hedge funds, we treat the holding positions in Schedule 13D/G and Form 13F according to the nature of their filing requirements. We consider the aggregated positions as hedge fund positions if the reporting entities jointly report beneficial ownership (Schedule 13D/G) with hedge funds.[20] For the cases, in which the hedge funds report their investment holdings (13F combination reporting) with non hedge funds, we separate the hedge funds' positions from other non-hedge fund ownership for this Form 13F.[21] Our results are also robust to other ways of measuring institutional holding following in the previous literature.[22]

[20] This is consistent with the beneficial ownership discloser requirement of the SEC. The SEC defines a beneficial owner as one or a group of investors holding directly or indirectly more than 5% of a firm. A member of joint filing is required to understand that such statement is filed on behalf of all such persons.

[21] Different to beneficial ownership filing, a 13F combination reporting is less likely to be considered by the SEC as an investment filing to be behalf of all members in a group. According to the SEC, only part of the securities with respect to which a money manager has investment discretion is reported by the reporting entity in a combination reporting.

[22] The maximum amount that is going to be different from the Form 13F holding is only when an institutional investor with a significant amount of ownership reduces the position before the end of the quarter. The maximum holding amount, therefore, offers us a better understanding for the ownership position truly held by hedge funds

[Insert Table II]

Table II presents descriptive statistics of institutional holdings for our sample of 1,271 takeover transactions in the four quarters before and the two quarters after the announcement of the merger deal. The first two columns of Table II provide the mean and median values for hedge fund and other institutional investor's ownership, respectively. Column 3 presents the difference and a test of significance between the hedge fund and other institutional investor samples. More importantly, we also present the percentage change in aggregated ownership positions from three quarters before to two quarters after the announcement, relative to the holdings in the 4th quarter prior to the announcement for both type of investors. Panel A of Table II shows that hedge funds in general tend to increase their stake more in target firms relative to non-hedge fund institutions. 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 non-hedge fund institutions.

We collect our short sale 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 (NASDQ), 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. This short sales data includes

around M&A events. In an unreported table, for example, we compare our data with that of 13F. We find that while the quarterly differences in mean and median institutional holding between our database and CDA/Spectrum 13F for acquirers are not significant, the differences are significant for the target firms in each of the three quarters prior to public announcement of the M&A deal.

information on ticker name, short sale volume, short sale price, transaction time and date, exchange listing, and trade type (whether they are market maker trades or not). These data are available from the first effective compliance day January 3, 2005 to July 6, 2007 after which the mandatory public disclosure of short sales data was eliminated.

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). 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 in NYSE, AMEX and NASDAQ and generate aggregated daily non-exempted short sale volumes for each stock.[23] This leaves us with a short sale sample consisting of 3,117 NYSE stocks, 1,353 AMEX stocks, and 3,915 NASDAQ stocks.

IV. Methodology and Results

To test the three hypotheses, we need to examine the magnitude of short-term hedge fund involvement in M&A deals by investigating the ownership stake in the target firms prior to the public announcement of the deal. We first define a short-term investor in this paper as a financial institution or individual who does not maintain a long-term relationship but takes a long position in the target firm shortly before the public announcement of the M&A deal. Specifically, 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 [-

[23] Non-exempted short sales exclude short sales made by the market maker.

1], and (2) the investor reports no or zero holdings in the target in each quarter from quarter [-4] to quarter [-2]. Finally, since Bodnaruk, Massa, and Simonov (2007) argue that investment banks possesses private information and their stakes are related to the 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, that 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.

IV. A. Propensity Score Matching for Target Firms

We first investigate whether short-term hedge funds adjust their *ex-ante* ownership in target firms based on potential insider information of forthcoming takeovers or simply due to their ability to identify potential target firms based on fundamental characters. We do this by employing propensity score matching. The propensity score algorithm allow us to examine short-term hedge fund holding of the treatment (actual targets) firms, in comparison to a matched control group of firms (similar firms but not a takeover target). 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 as measures of the firm fundamentals, such as sales growth, ROE, etc. In addition, we also include institutional ownership from CDA/Spectrum 13F, and Amihud illiquidity ratio as additional control variables as proxies for firm level information asymmetry. In the second step, we calculate each firm's propensity score based on the probability that a firm with given

characteristics will become a target. In the third step, firms are matched using Leuven and Sianesi's (2003) propensity score matching procedure to the nearest neighborhood within a 0.1 caliper. Specifically, we match the actual and potential target in the same Fama-French 49 industry category and same 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 position of matched actual and potential targets around takeover dates.

[Insert TABLE III]

Panel A of Table III 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. As mentioned before, we report the quality of our matches in Panel B of Table III. The results of these tests show no significant difference among the market and accounting performance between matched pairs of treatment and control firms. Panel C of Table III shows that hedge funds tend to take larger stakes in targets in all four quarters prior to the announcement. We analyze our main key variable, short-term hedge fund holding in Panel D of Table III. Consistent with our initial conjecture of equity stakes being purchased in actual targets based on potential private information, the results in Panel D shows that short-term hedge funds hold a significantly higher long position in the actual target's shares in quarter(-1) relative to other PS matched firms. Since these matched firms are similar in all other respects to the actual target firms, our result therefore implies that the long holdings of short-term hedge funds, cannot be completely explained by the ability of such hedge funds to correctly identify target firms.

IV.B. Univariate Analysis of Short-term Hedge Fund positions in Target firms

In this section we use a variety of univariate tests to test our first two hypotheses. We first investigate whether short-term hedge funds could potentially construct a profitable strategy by trading on private information. In Figure III, we present a graph of the Fama-French and the Momentum 4-factor adjusted cumulative abnormal returns around the takeover announcements for firms with high short-term hedge fund holdings and firms with low short-term hedge fund holdings. We classify a firm in a deal as high (low) if the short-term hedge fund ownership in 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 significantly underperform acquirers that have low short-term hedge fund holdings in their targets. This preliminary evidence is consistent with our hypothesis **H1** which suggests that targets in which short-term hedge funds hold larger long positions have higher premiums (or larger total returns).

Second, we evaluate the accuracy and profitability of short-term hedge funds investment strategies based on the characteristics of the deals they participate in, some of which are the target premium, the *ex ante* short selling of acquirer's shares, and the deal success rate. Finally, we analyze the potential profitability of *ex ante* short selling in the acquirer's stock prior to the deal announcement date categorized by the level of the short-term hedge fund's long stake in the corresponding targets. Based on Schwert's (2000) definition of Target Abnormal Return

Premium and following Bodnaruk, Massa, and Simonov (2009), we measure the target premium as the Fama-French and momentum 4-factor return of the target's stock from three months prior to the deal announcement to two months after the deal announcement or resolution date, whichever comes first as follows:

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

where R_{it} is the continuously compounded return on target firm i on trading day t relative to the takeover announcement date and **X** is a vector of the Fama-French Momentum 4 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 and momentum 4-factor return of the acquirers into the previous month's "runup" (-22,-1) and following 2-month (0, 42) "markup". The results presented in the tables, uses the standard Fama-French 4 factor model which probably provides the most appropriate measures of target premium since it controls both firm size and market momentum factors that have been shown by previous papers to systematically affect market premium.[24]

In addition to buying target shares in high premium deals, another component of a profitable strategy of short-term hedge funds in a stock deal, is to short the shares or long the puts of the acquirer *prior* to the public announcement of the deal, following which the acquirer's stock price declines. Figure IV indicates the average abnormal short-selling and abnormal put-

[24] Among others, Gompers and Metrick (2001), shows that institutional investors tend to invest in large liquid firms. On the other hand, Moeller, Schlingemann, and Stulz (2004) documented that announcement return of small firms is significantly better than that of large firms in takeovers. Furthermore, Rosen (2006) provides empirical evidence that takeover returns is positively related to market momentum, particularly that mergers announced during hot stock markets tend to get a better reaction from the market than those announced in a cold market.

buying prior to the takeover announcement for acquiring firms in stock deals. The results are classified based on high and low short-term hedge fund holdings in corresponding target firms.

To further examine potential insider trading by hedge funds,we investigate the abnormal short selling and abnormal put buying for acquirers in the 5-day and 10-day window prior to the public announcement of the deal. Following the approach in Christophe, Ferri, and Angel (2004), we defined abnormal short-selling as the difference between the average daily short selling in the acquirer's shares in the five (ten) trading days prior to announcement and the average daily short selling in acquirers' shares during a non-event window much prior to the takeover. This average short selling, *AVESS*, is measured on the 255 trading days ending at day –64, requiring short selling records for at least 63-days during that window, otherwise the average short selling is measured by the 255 trading days after day 0. For example, the abnormal short-selling *ABSS* (-5,-1) of one stock during the five days prior to announcement is formally measured as

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

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

To investigate short-term hedge fund's potential trading on insider information using put option, we investigate the daily net long put options. 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

$$ABLongPut_t = \frac{\sum_{j=1}^{N_{i,t}} NVOL_{i,j,t}^{LongPut} - (1/255)\sum_{i=11}^{266}\left(\sum_{j=1}^{N_{i,t}} NVOL_{i,j,t-i}^{LongPut}\right)}{std\left(\sum_{j=1}^{N_{i,t}} NVOL_{i,j,t-i}^{LongPut}, i = 11,12,...,266\right)},$$

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, shares of the corresponding acquirers are more likely to be abnormally short sold *prior* to the takeover 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.

[Insert Table IV]

In Table IV, we present target premium, acquirer runup and markup, deal characteristics, and abnormal short sale and put option trading volume in Reg. SHO period, a period that we have all variables of interest available. Table IV describes how they differ across deals associated with short-term hedge fund and non-hedge fund institution ownership of target's shares. Panel A of Table IV examines all the M&A deal, while Panel B only examines the M&A deals with stock payment. 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 provides these statistics for subsamples associated with below median (low) and above median (high) short-

term hedge fund stakes in target's shares, respectively. Column 4 displays the level and significance of differences between the two subsamples. Finally, the other columns for the non-hedge fund institutional holdings are constructed in same way.

Panel A shows that the target premium for high short-term hedge funds holdings is higher. In particular, the mean (median) of target premium is 31.37% (26.57%) for targets in high group while it is 20.09% (19.96%) for targets in the low group. The difference is significant at 1% level. Conversely, the difference is not significant for the non-hedge fund short-term holdings of the target's shares. Interestingly, the deal success rate is significantly lower in the high short-term holding group. As expected, the results for the stock deals (see Panel B) shows that in comparison 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 significant. 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 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.

So far our preliminary evidence show that the short-term hedge funds are more likely to take long positions in targets with high premium and the corresponding acquirer's shares are more likely to experience a high level of abnormal short selling activities during the period prior to the deal announcement date. The logical subsequent question to ask is whether the short selling activities prior to the public announcement of M&A deals are more profitable. To answer this question we construct a simple straightforward strategy where we consider the daily actual average abnormal short-selling volume in the 20 days prior to the announcement. In Table V the

first column called "shorting day" indicates the day of the abnormal short-selling relative to day zero (takeover announcement day). For each day, we allow short sellers to close their positions on either the announcement date, or one day, two days and up to 20 days after the takeover announcement. We call these "short position closing days". Profit (in thousands of dollars) is defined as $profit_t$ = ($Short\ Price_t$ -Ask_n)×$Short\ Volume$, whereas $Short\ Price_t$ refers to the weighted average short selling price at shorting day t, and Ask_n refers to the close ask price on the n^{th} trading day after the announcement. The results in Panel B of Table V, show that the 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. For example the total abnormal short-selling in the high short-term hedge fund group on day -20 would make an *abnormal* profit of approximately $14.9 million, $13.4 million and $12.3 million if it closed out its positions on day 0 (the amendment announcement date), day 1 after and day 2 after, respectively. If we consider the actual short-selling volume rather than abnormal short-selling volume then total short-selling profits would also be even larger, i.e., on day -20 the total profits from actual short-selling the hedge fund borrowers equity is approximately $33.0 million if the position was closed on day 0. In comparison to the short sellers of the low short term hedge groups, those for the short sellers would mostly generate losses in abnormal measure or very low profit in actual terms following a similar strategy, see Panel A of Table V. Both abnormal and actual short selling profits gradually diminish with the number of days to the takeover announcements, suggesting the value of information is exhausted quickly by the larger number of insiders.

[insert Table V]

In summary, our results in this section provide strong support for our first two hypotheses. Short-term hedge funds are more likely to take abnormally long positions of targets in M&A

deals with high target premium. The acquirers in M&A deals with larger preannouncement target stakes of short-term hedge funds are more likely to be abnormally sold short in stock deals prior to public announcement. In addition, we show that such a strategy could be potentially very profitable.

IV.C. Multivaiate tests

In this section we test our three hypotheses using a variety of multivariate test.

IV.C.1 Hypothesis 1

Short-term hedge funds are more likely to take abnormally long positions of targets in M&A deals with high target premium. We first formally test the Hypothesis I in the following model:

$$\begin{aligned} Holdings = {} & \alpha + \beta_1 Premium + \beta_2 Success + \beta_3 Markup + \beta_4 Runup \\ & + \mathbf{X}_{Deal\ Charactors}\kappa + \mathbf{X}_{Controls}\varphi + \varepsilon \end{aligned} \qquad (A.1)$$

where *Holdings* is the holdings for short-term hedge funds in one quarter before the announcement, *Premium* is the target premium, *Success* is a binary variable relating to the actual outcome of the deal, *Runup* and *Markup* are acquirer runup and markup discussed above, $\mathbf{X}_{Deal\ Charactors}$ is the matrix for specific characters associated with M&A deals, and $\mathbf{X}_{Controls}$ is a matrix composed of the standard set of control variables commonly employed in the M&A literature, following Schwert (2000).

Larcker and Lys (1987), argues that traders utilize their superior abilities to predict offer outcomes, and the change in their holdings is positively related to the expected probability of success, namely $\beta_2 > 0$ in $(A.1)$. On the other hand, one could argue that the target price tends to adjust upward according to the announced target premium rapidly, and the high target premium

increases the possibility of deal withdrawal. Accordingly, one might not observe the short-term hedge funds with short investment horizon will wait until the completion of the takeover to realize their profit from acquirers rather than to sell their target stocks in market to pursue a better annualized the return. Based on those arguments, $\beta 2$ could be either positive or negative.

[Insert Table VI]

Based in our earlier results in Figure I, In Table VI, we presented our results into three groups full sample (Panel A) pre-2003 subsample (Panel B) and post-2003 subsample Panel (C). In total we have 791 observations out of 1,271 M&A in the time period 2000 to 2007 has positive short-term hedge funds ownership. Through Panel (A) to Panel (C) of Table VI, we examine two regression models to show the robustness of our results by including firm characteristic variables and year fixed effects.

Panel A of Table VI shows that preannouncement short-term hedge fund holdings are significantly and positively correlated to the target premium and significantly and negatively correlated to acquirer markup, the stock deal dummy, and deal duration. The significant coefficient estimates of Herfindahl-Hirschman Index and market to book ratio in model (2) suggests that short-term hedge funds prefer growing targets in concentrated industries, which require less *ex-ante* effort to identify.

Consistent with our Figure I, the US M&A activity peaked during 2000 and declined dramatically to a trough in 2002, following two years of economic recession and terrorism concerns. According to SDC, the dollar value of US M&A transactions in 2002 is merely 25.85% of that figure in 2000. Some authors, such as DePamphilis (2009), in fact consider the resurgence in M&A over 2003-2007 periods as a new wave of M&A. Additionally, Greenwood and Schor (2009) shows that hedge fund filings increase dramatically in 2003 or later. This is

consistent with our Figure I and Table I in which the hedge fund industry experiences a structural change in their investment strategy in M&A events around 2003. Therefore, we test whether the misuse of inside information by short-term hedge funds in M&As is similar before and after 2003. The results of Chow tests by target premium, acquirer markup, and runup confirm our concerns that a significant difference between the regression coefficients in the two sub samples. Interestingly, in post-2003 period, in addition to the significance of the target premium and acquirer mark up the acquirer run up is positive and significant. In general, our results in this section are consistent with hypothesis 1.

IV.C.2 Hypothesis 2: *Preannouncement Short-Selling, Put-Buying and Short-term Hedge Fund Holding*

To test the second hypothesis, we generally investigate the relationship between the preannouncement abnormal short-selling of acquirer in the equity and the option markets and short-term hedge fund holdings of targets. We also consider an alternative measure to abnormal short selling, the relative short size *RELSS*(-5,-1) that is measured as the ratio of nominal (actual) short selling to trading volume for the stock over the interval of day -5 to -1. Specifically, the three regression models are following:

$$\begin{aligned} ABSS(-5,-1) &= \beta_0 + \varphi_1 Holding + \varphi_2 stock \times Holding + \beta_2 RET(-5,-1) \\ &\quad + \beta_3 ABVOL(-5,-1) + \varepsilon \qquad (B.1) \\ RELSS(-5,-1) &= \gamma_0 + \varphi_1 Holding + \varphi_2 stock \times Holding + \gamma_2 RET(-5,-1) \\ &\quad + \gamma_3 NORMRELSS + \varepsilon \qquad (B.2) \\ ABLongPut_t(-5,-1) &= \delta_0 + \varphi_1 Holding + \varphi_2 stock \times Holding + \delta_2 RET(-5,-1) \\ &\quad + \delta_3 ABVOL(-5,-1) + \delta_5 ABOPTVOL(-5,-1) + \varepsilon \qquad (B.3) \end{aligned}$$

where *RET*(-5,-1) is the return on the acquirer stock from the closing prices of day -6 to -1, *ABVOL*(-5,-1) is the average daily abnormal 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 stock during the non-announcement period which is defined outside the event window, e.g. (-63, 0), and *ABOPTVOL*(-5,-1) is the average daily abnormal long(short) option in the acquirer stock(both put and call) over the interval of day -5 to -1. Following Christophe, Ferri, Angel (2004) and Poteshman (2006), the variable *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. And the variable *NORMRELSS* is a cross sectional control for each firm's typical ratio of shorted shares to traded shares during the non-announcement period.

[Insert Table VII]

The total sample size with short selling data (reg-sho period) for the acquirer is 277 firms. The results in columns 1 of Table VII show that there is a significantly positive relationship between the preannouncement short-term hedge fund holding of target and abnormal short-selling of acquirer *ABSS*(−5,−1) in stock payment takeover deals. Similar results are obtained when we consider an alternative measure of abnormal short selling, the relative short selling variable *RELESS*(-5,-1), see model (*B*.2) of Table VII.

For the abnormal put buying option, for the period during post-2003 and Reg-sho period, columns 4 and 5 of Table VII, there are significant and positive relationship between preannouncement hedge fund stakes for the stock deals and put buying of acquirers one week prior to announcement. However, this result does not hold for M&A deals prior to 2003, see Column 3 of Table VII,. These results support our *Hypothesis* 2, The acquirers in M&A deals with larger preannouncement target stakes of short-term hedge funds are more likely to be

abnormally sold short in stock deals prior to public announcement.

IV.C.3 Hypothesis 3: *Preannouncement Insider Trading and Short-term Hedge Fund Holding*

This main purpose of this section is to show whether the short selling activities in the equity market or the option market is informed which is a direct test to our third *Hypothesis*. One common approach in the literature to tackle this issue, see for example Christophe, Ferri and Angel (2004), is to investigate the relationship between pre-announcement stock short sale and post-announcement stock price change. Accordingly, we consider the following three models:

$$\begin{aligned} ABSS(-5,-1) &= \beta_0 + \beta_1 RET(0,+1) + \beta_2 RET(0,+1) \times Abv.Median \\ &\quad + \beta_3 RET(-5,-1) + \beta_4 ABVOL(-5,-1) + \varepsilon \qquad (C.1) \\ RELSS(-5,-1) &= \gamma_0 + \gamma_1 RET(0,+1) + \gamma_2 RET(0,+1) \times Abv.Median \\ &\quad + \gamma_3 RET(-5,-1) + \gamma_4 NORMRELSS + \varepsilon \qquad (C.2) \\ ABLongPut_t(-5,-1) &= \delta_0 + \delta_1 RET(0,+1) + \delta_2 RET(0,+1) \times Abv.Median \\ &\quad + \delta_2 RET(-5,-1) + \delta_3 ABVOL(-5,-1) + \delta_5 ABOPTVOL(-5,-1) + \varepsilon \qquad (C.3) \end{aligned}$$

where the variable $RET(t_1, t_2)$, measured as the return on the stock from the closing prices of day t_1 to t_2. the other variables as identified before. Our proxy variables for informed short selling in equity or option market are *RET(0,+1) and RET(0,+1)* interacted with above median hedge fund holdings *(abv Median)*. The independent variable *RET*(0,+1) is the announcement effect of the acquirer and conveys if the market's reaction to the announcement reveals whether the announcement contained a surprise. Thus, a negative 2-day return means that the market viewed the M&A announcement as a negative surprise, and a positive return means that the M&A announcement was a positive surprise than most investors had expected. Therefore, a statistically significant and negative β_1 would mean that short-selling rises prior to disappointing news and falls before announcements that improves stock prices of acquirers. Similarly, if only

the coefficient β_2 on the interaction term of *RET*(0,+1) and the above-median short-term hedge fund dummy was negative and significant it would indicate that these high-short-term hedge funds *ex-ante* perceived the negative market reaction to the M&A deals, thus supporting our hypothesis of informed short selling prior to the announcement of M&A deals. Following Christophe, Ferri and Angel (2004), our regressions also contain two control variables. The first, *RET*(−5,−1), represents the movement of the stock price during the five days prior to the announcement. This variable controls for the possibility that upward or downward changes in the stock price might affect the level 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 now "over-valued" stock. With this control variable in place, the model does not wrongly attribute all pre-announcement short-selling to expectations regarding the M&A deal. 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 regression to estimate our three models. 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. We considered an acquirer firm in low (high) short-term hedge fund holding group if short-term hedge fund holding of its target is below (above and equal to) the median of the distribution of all takeover target firms in given year. Panels A, B and C of Table VIII presents our results for models *C*.1, *C*.2, and C3, respectively. As you can see from Panels A and B, there are a significantl negative relationship between the post-announcement return, *RET*(0,+1), and ex-ante abnormal short-selling

announcement, *ABSS*(−5,−1) in the high short-term hedge fund group and the interaction between *RET*(0,+1) and high short-term hedge fund group (*(abv Median)*. Similar results are obtained for the put option markets (see Panel C) but the results are significant for two sample periods (reg-sho and post-2003 periods).

Our findings in option market are consistent to Cao, Chen and Griffin (2006) which documents a strong relation between preannouncement option trading activity and takeover returns. In summary, our results consistent with informed short trading especially for the high hedge fund holding subsample. Accordingly, these results provide support to our *hypothesis* 3 Active informed trading prior to M&A announcements are more likely to be observed in takeover deals with larger preannouncement target holdings of short-term hedge funds.

IV.D. Robustness Tests

We conduct several robustness tests of our results, to establish that the investment strategies observed for short-term hedge funds are consistent with the idea that such funds may be trading based on private information prior to the public announcement of takeovers. We investigate whether our results are robust by sorting our M&A deals based on either target premium or double sorting by target premium and abnormal short selling. In Table IX we sort all deals into High (above median) and Low (below median) groups based on target premium. Panel A presents the results for all deals while Panel B presents the results for the stock deals. As expected, the short term hedge fund holdings of the target shares are larger and significant for the high group in both Panels A and B. The abnormal short selling of the acquirer's shares is significantly higher for the high group when considering only positive hedge fund stakes. Further, we find that short-term hedge funds with higher stakes in target firms unwind their positions

significantly faster in the quarter after the public announcement of the deal than those that have smaller stakes in target firms.

[Insert Table IX]

Our results are also robust when we consider the double sorting in Table X in which we first sort all the deals into above median and below median groups based short-term hedge fund holding in the quarter prior to the M&A announcement. Deals within each group are then assigned into above median and below median classes based on Abnormal Short Sale 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 stakes subsamples) and in the High-High (above median class for both abnormal short selling and short-term hedge fund stakes subsamples) groups. In this Table we also introduce one more measure of the profitability; total return which is measured by subtracting the acquirer's CAR from its target's premium measured over the same event window. Similar to Table V, 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). Consistent with our previous results, the target premium, acquirer abnormal short selling and short term-hedge fund holdings of target's shares is larger for the High-High group for all deals (Panel A and for the stock deals (Panel B). Further, we find that the total return is significantly greater for the high-high deals compared to the low-

low deals. Interestingly, the profitability of the short selling for the acquirer's shares is larger for the high-high group but it is only significant for the stock deals.

[Insert Table X]

V. Conclusion

In this paper, we investigate short-term hedge funds trading actvities in the equity and option market prior to the announcement date of M&A deals . Our measure of short-term hedge fund holding is based on positive holding in the quarter prior to M&A deal with the same hedge fund holding no (zero) stake in the target firms in the four preceding quarters. This measure allows us to better capture advantages arising due to insider information and allows us to exclude other potential explanation such as activism and monitoring. We find that on average short-term hedge funds purchased 3.2% of target shares in the quarter immediately prior to the public announcement of M&A deals. Importantly, these stakes are positively related to the takeover premium, the short-selling in the acquirer stock, and the overall profitability of such trades prior to the deal announcement. In addition, we find that abnormal short selling for the acquirers in the equity and option markets is negatively related to the acquirer stock returns after the M&A announcement date especially for the high-short-term hedge fund holding group. These results are consistent with informed short selling activities, see for example, Christophe, Ferri, and Angel (2004). Accordingly, our results are consistent with the view that short-term hedge funds are able to obtain material non-public information concerning takeover deals prior to the public announcement of such deals. These hedge funds then exploit their informational advantage by taking simultaneous positions in targets (long on the target shares) and their corresponding

acquires (shorting the acquires shares) prior to the public M&A announcement date. We also demonstrate, using a variety of tests and controls, that such trading activity cannot be explained by the superior ability of the short-term hedge funds to select potential targets prior to takeover announcements. These findings raise important policy concerns with respect to hedge fund regulations especially as relates to hedge fund activities around M&A deals.

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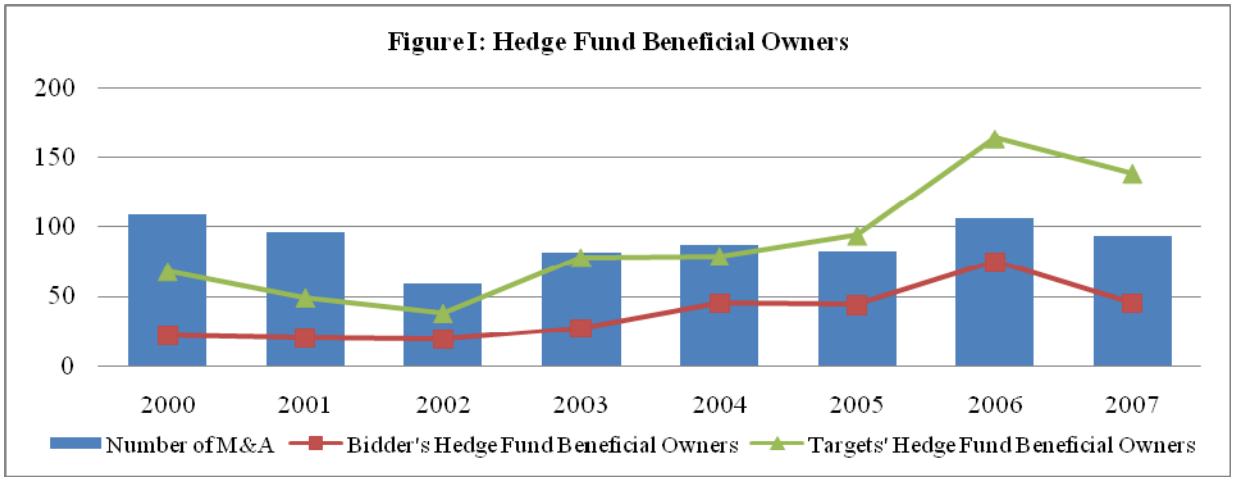


Figure II: Definition of Quarters Relative to the Announcement

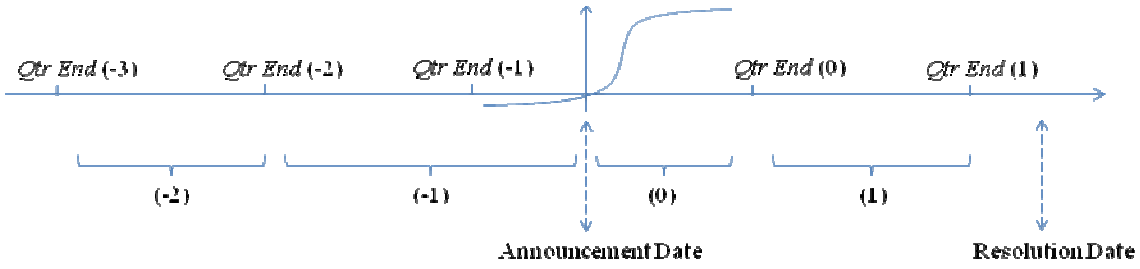
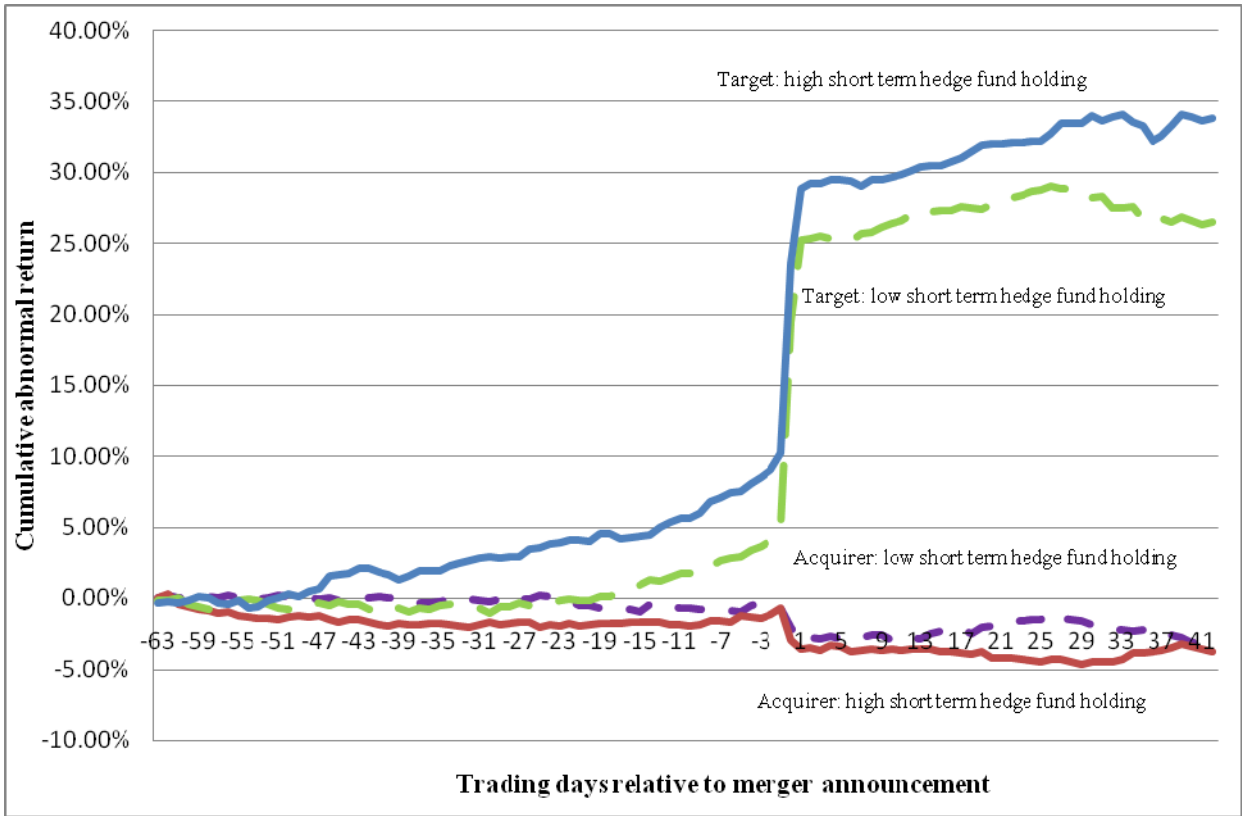


Figure III: Cumulative abnormal return around acquisition announcement: Firms with high short-term hedge fund stakes versus firms with low short-term stakes

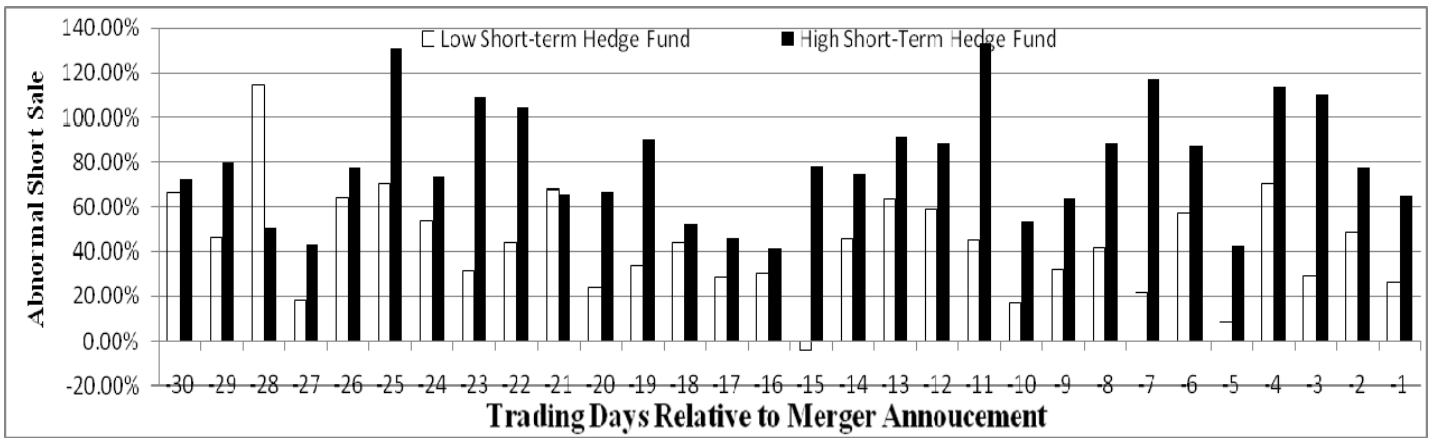


Cumulative abnormal returns for target and acquirer firms are measured by Fama-French and momentum four-factor model using 255 trading day prior to -42 before the announcement date. According to their short-term hedge fund holdings, we separate our data into three groups in a given year. A target (acquirer)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

The daily abnormal short is measured as the ratio between short sale in the given day and average short sale outside the event window (-63, 42) minors 1. The daily abnormal put buying is measured similar to that in Poteshman (2006). 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 stake group if its short-term hedge fund stake is in the top group of the distribution of all takeover target (acquirer) firms in given year. Inversely, a target (acquirer) is considered in low short-term hedge fund stake group if its short-term hedge fund stake is in the bottom group of the distribution of all takeover target (acquirer) firms in given year.

Panel A:



Panel B:

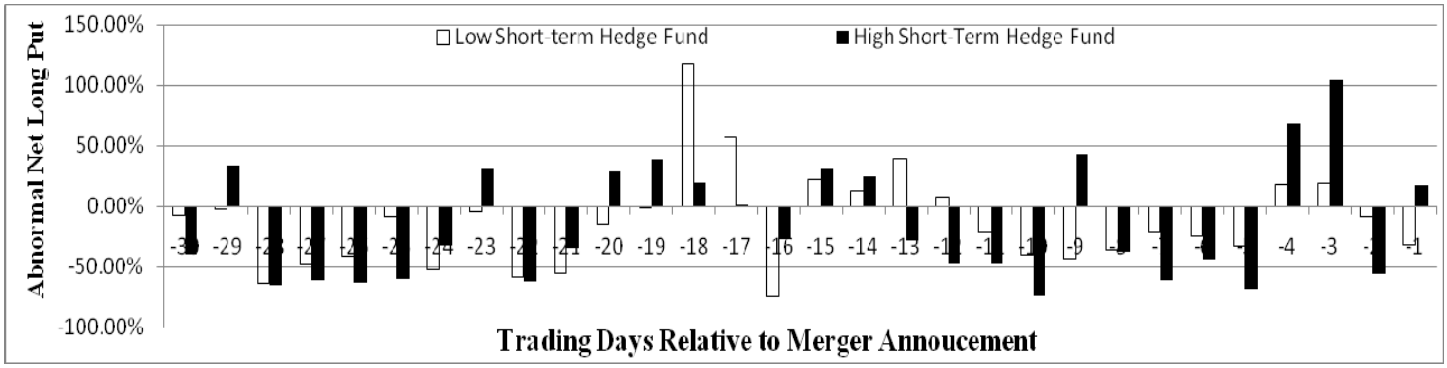


Table I: The Number of 13D/G Filling Activities of M&A Firms across Sample Period

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. The activism 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. The 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. 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 Activism Owners	Other Institutional Activism Owners	Hedge Fund Non-Exempted Owners	Other Institutional Non-Exempted Owners
			Panel A: *M&A Acquirer*		
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
			Panel B: *M&A Target*		
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: Hedge Fund and Non-Hedge Fund Institutional Investor Ownership in Targets

We report the descriptive statistics for target ownership of hedge funds and other non-hedge fund institutional investors surrounding M&A from 4 quarters before to 2 quarters after the public announcement. The institutional ownership of an M&A firm in each quarter is calculated by aggregating maximum holding from three types of SEC filings, Form 13F, and Schedule 13D/G. 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, respectively. Panels A, B, and C report the descriptive statistics for full, completed and withdrawn deals respectively. Change percentages are measured by the mean (median) of aggregated stakes.

Panel A – Full Sample							
	Hedge Fund	Other Investors	Difference		Hedge Fund	Other Investors	Difference
	Aggregated Stakes				Change Percentage Based on Quarter (-4)		
Qtr(-4)	11.28%	31.19%	19.91%	***			
	[7.39%]	[24.01%]	[16.62%]	***			
Qtr(-3)	12.09%	32.63%	20.54%	***	7.21%	4.62%	2.59%
	[7.91%]	[26.49%]	[18.58%]	***	[7.02%]	[10.35%]	[-3.33%]
Qtr(-2)	13.48%	35.08%	21.60%	***	19.47%	12.46%	7.01%
	[10.29%]	[29.89%]	[19.60%]	***	[39.22%]	[24.50%]	[14.72%]
Qtr(-1)	15.55%	36.93%	21.38%	***	37.88%	18.41%	19.47%
	[11.49%]	[31.71%]	[20.22%]	***	[55.50%]	[32.09%]	[23.41%]
Qtr(0)	18.89%	26.35%	7.46%	***	67.44%	-15.53%	82.98%
	[14.25%]	[22.14%]	[7.88%]	***	[92.84%]	[-7.80%]	[100.64%]
Qtr(1)	10.27%	12.35%	2.09%	***	-8.97%	-60.39%	51.42%
	[1.08%]	[0.58%]	[-0.50%]		[-85.38%]	[-97.59%]	[12.22%]
Obs.	1122	1122			1122	1122	
Panel B – Completed Deals							
Qtr(-4)	11.12%	30.57%	19.44%	***			
	[7.32%]	[23.31%]	[15.99%]	***			
Qtr(-3)	11.95%	32.05%	20.11%	***	7.44%	4.87%	2.57%
	[7.75%]	[25.87%]	[18.12%]	***	[5.98%]	[11.01%]	[-5.03%]
Qtr(-2)	13.24%	34.45%	21.21%	***	19.07%	12.71%	6.36%
	[10.07%]	[29.19%]	[19.12%]	***	[37.66%]	[25.24%]	[12.42%]
Qtr(-1)	15.32%	36.31%	21.00%	***	37.73%	18.80%	18.92%
	[11.32%]	[31.01%]	[19.69%]	***	[54.69%]	[33.05%]	[21.64%]
Qtr(0)	18.54%	25.29%	6.75%	***	66.73%	-17.27%	83.99%
	[13.92%]	[20.74%]	[6.82%]	***	[90.27%]	[-11.00%]	[101.27%]
Qtr(1)	8.90%	10.07%	1.17%		-19.97%	-67.05%	47.08%
	[0.07%]	[0.01%]	[-0.06%]		[-99.00%]	[-99.95%]	[0.95%]
Obs.	1005	1005			1005	1005	
Panel C – Withdrawn Deals							
Qtr(-4)	12.64%	36.56%	23.92%	***			
	[9.15%]	[32.42%]	[23.27%]	***			
Qtr(-3)	13.32%	37.60%	24.27%	***	5.42%	2.84%	2.58%
	[9.16%]	[36.38%]	[27.22%]	***	[0.17%]	[12.22%]	[-12.04%]
Qtr(-2)	15.48%	40.48%	25.00%	***	22.49%	10.71%	11.78%
	[12.32%]	[39.39%]	[27.08%]	***	[34.65%]	[21.50%]	[13.15%]
Qtr(-1)	17.57%	42.25%	24.68%	***	39.02%	15.57%	23.45%
	[13.82%]	[39.32%]	[25.50%]	***	[51.08%]	[21.29%]	[29.79%]
Qtr(0)	21.84%	35.43%	13.59%	***	72.85%	-3.09%	75.93%
	[18.13%]	[32.34%]	[14.21%]	***	[98.17%]	[-0.26%]	[98.43%]
Qtr(1)	22.02%	31.97%	9.95%	***	74.20%	-12.56%	86.77%
	[18.17%]	[29.55%]	[11.38%]	***	[98.61%]	[-8.86%]	[107.47%]
Obs.	117	117			117	117	

TABLE III: Short-term Hedge Fund Ownership in Target Firms after Propensity Score Matching

This Table reports the characteristics of the propensity score matched hedge fund holding of targets during the sample period from 2000 to 2007. We conduct propensity score matching (PSM) based on Result of Logistic Regression on the probability of becoming a target by Model (3) in Panel (A) using the nearest neighborhood within a 0.1 caliper. After PSM, we have 1271 observations in each of the treatment (actual target) and the matched sample (potential target) before removing the M&A without either completion or withdrawal date. Panel (B) summarizes the actual and potential target companies' characteristics. Panels (C) and (D) report the difference between the treatment and matched firms for hedge fund and short-term hedge fund holding respectively. *Market capitalization* is defined as the last trading day *log(*1+price × number of share outstanding) 46 trading day prior to announcement. *Return on Equity* (ROE) is the ratio of earnings to average equity, defined as (COMPUSTAT items 20/(60 + 60(t – 1))/2). *Market to Book* (M/B) is the market-to-book ratio, defined as (COMPUSTAT items 9/60). *Growth of sales* (Growth) is the growth rate of sales over the previous year, defined as (*log*(1+COMPUSTAT items 12/12(t –1))). *Accounting liquidity* (Liquidity) is the ratio of net liquid assets to total assets, defined as (COMPUSTAT items (4–5/6)). *Price to Earnings* (P/E) is the ratio of the year-end stock price to earnings per share, defined as (COMPUSTAT items 24/58). *Debt to Equity* (D/E) is the ratio of debt to equity, defined as (COMPUSTAT items 9/60). *Herfindahl-Hirschman index* (HHI) is calculated using industry sales data (COMPUSTAT item 12). 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 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		Yes						
Pseudo R-Square		0.042		0.055		0.073						
Number of Cases		59128		59044		59044		1094		1094		1094

Quarters Relative to M&A Announcement	Panel(C): Hedge fund holding in Target							Panel(D): Short-term hedge fund holding in Target						
	Treatment		Match		Difference			Treatment		Match		Deference		
	Mean	Std.	Mean	Std.	Mean	Std.		Mean	Std.	Mean	Std.	Mean	Std.	
***qtr*(-4)**	12.36%	13.49%	10.35%	10.71%	2.78%	13.74%	***							
***qtr*(-3)**	12.82%	13.11%	11.03%	11.17%	2.29%	13.40%	***							
***qtr*(-2)**	13.67%	13.02%	11.55%	11.60%	2.78%	13.64%	***							
***qtr*(-1)**	15.77%	16.01%	12.01%	12.20%	4.37%	16.52%	***	3.19%	6.82%	1.74%	3.80%	1.41%	7.48%	***
***qtr*(0)**	19.43%	17.09%	12.23%	12.04%	7.89%	16.18%	***	1.65%	3.74%	1.19%	2.65%	0.47%	4.48%	***
***qtr*(1)**	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 IV 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 further divided 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 and momentum 4-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. *Acquirer Run-up return* is defined as the Fama & French and momentum 4-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 and momentum 4-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 $R_t = \left(P_{i,t}^T + D_{i,t}^T\right)/P_{i,t-1}^T - 1 - r_{f,t}$, where superscript *T* stands for target. The arbitrageur return of stock deal is defined as

$$R_t = \left[\left(P_{i,t}^T + D_{i,t}^T\right)/P_{i,t-1}^T - 1 - r_{f,t}\right] - \delta\left(P_{i,t-1}^A/P_{i,t-1}^T\right)\left[\left(P_{i,t}^A + D_{i,t}^A\right)/P_{i,t-1}^A - 1 - r_{f,t}\right],$$

where superscript *A* stands for acquirer, δ is the hedge ratio, and r_f is the risk free rate. A acquirer's Abnormal short selling during 10 or 5 trading days prior to the M&A announcement, is measured by following Christophe Ferri and Angel (2004). The *Abnormal Put buying* is defined in the similar method by following 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 [Median]	Mean [Median]	Mean [Median]	Mean [Median]		Mean [Median]	Mean [Median]	Mean [Median]	Mean [Median]	
Panel A: All M&A in Regulation SHO Period										
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%]	
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%]	
Panel B: All Stock Payment M&A in Regulation SHO Period										
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%]	
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 V: Dollar Profit from Short Selling Acquirers in Stock Deals

This table summarizes the profits (in thousands of dollars) that short seller can make around stock payment takeover announcement dates based on short-term hedge fund ownership position of target during the sample period from January 3nd 2005 to July 6th 2007. Shorting Day refers to the day on which short sellers start their shorting position and day 0 is defined as the announcement date, or the next trading day if the announcement date is not a trading day. Short Position Closing Day refers to how many days after the takeover announcement short sellers fully recover their shorting position by purchasing back the securities they short sold before. Closing Day0 means that short sellers will close all their shorting position on the announcement day of the takeover. Profit (in thousands of dollars) is defined as $profit_t = (Short\ Price_t - Ask_n) \times Short\ Volume$, whereas $Short\ Price_t$ refers to the weighted average short selling price at shorting day t, and Ask_n refers to the close ask price on the n^{th} trading day after the announcement. Profit from abnormal short selling calculated by abnormal short volume, which refers to the abnormal number of shares being shorted on day t, while profit from total short selling calculated by short volume, which refers to the total number of shares being shorted on day t

	Dollar profit from abnormal short selling						**Dollar profit from total short selling**					
	Short Position Closing Day Post Announcement						Short Position Closing Day Post Announcement					
	0	**1**	**2**	**10**	**15**	**20**	**0**	**1**	**2**	**10**	**15**	**20**
Shorting Day	**Group 1: the acquirers in the deals with low short-term hedge fund target ownership**											
-20	-1632.83	-3598.40	-3543.39	-5424.01	-4329.65	-6453.81	1794.22	5199.43	6227.68	7904.14	13645.76	12769.62
-19	-1688.65	-4031.81	-3838.61	-6409.80	-5826.65	-7161.30	2604.39	5859.87	7178.25	7750.49	13123.33	12846.80
-18	-7460.76	-8556.16	-7323.85	-12640.17	-8936.68	-9950.89	-2932.45	2883.36	6133.58	4211.21	11152.45	11447.42
-17	-5146.82	-6278.28	-5360.14	-8683.30	-3392.72	-3927.29	-1363.65	5274.56	8782.91	7592.50	16657.37	16716.59
-16	-3398.76	-5278.33	-5287.12	-4885.47	-1358.99	-3899.88	4508.17	9737.49	11878.41	15415.19	22302.98	20906.52
-15	-2769.83	-5012.80	-4990.46	-10634.87	-7141.02	-10049.40	6325.89	10624.09	12417.65	10739.59	17239.91	15949.07
-10	-3707.65	-5548.64	-4576.21	-8481.38	-4904.61	-6944.43	3434.82	8227.37	10994.70	11289.76	17828.05	17429.85
-5	-1842.75	-4587.03	-5215.07	-9043.37	-8086.63	-9912.42	10472.35	13952.66	14846.89	15728.42	19391.09	19547.70
-1	-4094.59	-4514.19	-4834.79	-7639.87	-6779.51	-8336.29	10635.44	16640.31	17976.87	19855.17	23549.85	23800.86
sum(-20,-1)	-70778.89	-96611.60	-91974.72	-169824.53	-119816.94	-161586.57	122667.12	225054.63	262966.59	267880.40	380114.46	371164.68
	Group 2: the acquirers in the deals with high short-term hedge fund target ownership											
-20	14983.27	13441.15	12299.10	13797.56	16358.12	17640.17	32959.10	33005.28	29840.78	26348.75	30970.41	24688.65
-19	13399.09	14741.73	12576.35	7440.69	17233.52	13677.41	32794.16	35725.10	31537.27	21411.12	33265.05	22145.13
-18	6242.17	9952.02	6915.92	-1310.64	13845.53	10222.28	24287.04	29585.20	24526.65	11309.59	28526.87	17339.80
-17	7228.47	11708.15	7863.09	1644.19	12661.50	12764.11	22945.75	29013.73	23146.22	11936.83	25015.24	17554.03
-16	-152.56	3202.54	903.97	-1499.49	8186.91	10390.22	17546.20	22489.61	18168.58	10774.63	22522.14	17161.64
-15	4425.11	6013.51	4267.92	-2370.94	2692.19	-2985.37	23532.23	26708.95	22940.90	11311.55	18435.79	5194.41
-10	-1297.16	575.04	-1107.97	-5790.08	253.08	1174.32	15467.79	18954.78	15250.33	5579.48	13653.22	7048.48
-5	-5148.72	-2584.85	-4528.84	-6658.03	-1466.71	-774.00	9599.09	13777.75	9812.32	2694.38	9916.29	3083.03
-1	1057.76	4335.24	2070.29	1163.75	6793.34	8026.55	19186.30	24078.57	19792.19	13896.90	21557.08	15264.32
sum(-20,-1)	27275.76	69891.25	20696.66	-79675.03	45084.74	14417.78	367546.92	442226.54	352576.28	152371.22	318048.84	136511.60

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

Table VIII presents the results from the OLS estimations of short-term hedge fund stakes prior to public announcement. The regression model is specified as following: $Holdings = \alpha + \beta_1 Premium + \beta_2 Success + \beta_3 Markup + \beta_4 Runup + \mathbf{X}_{controls}\kappa + \varepsilon$ (A)

Target premium is defined as the Fama & French and momentum 4-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. *Holding on Acquirer* is an aggregated ownership of acquirer in the quarter prior to the public announcement by short-term hedge funds establishing long position on target right before announcement. *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. Small sample *t*-values are in bracket below the coefficients in 2SLS 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 Holding on 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 Control	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

$$ABSS(-5,-1) = \beta_0 + \varphi_1 Holding + \varphi_2 stock \times Holding + \beta_2 RET(-5,-1) + \beta_3 ABVOL(-5,-1) + \varepsilon \quad (B.1)$$

$$RELSS(-5,-1) = \gamma_0 + \varphi_1 Holding + \varphi_2 stock \times Holding + \gamma_2 RET(-5,-1) + \gamma_3 NORMRELSS + \varepsilon \quad (B.2)$$

$$ABLongPut(-5,-1) = \delta_0 + \varphi_1 Holding + \varphi_2 stock \times Holding + \delta_2 RET(-5,-1) + \delta_3 ABVOL(-5,-1) + \delta_5 ABOPTVOL(-5,-1) + \varepsilon \quad (B.3)$$

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 *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 1. 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 buying option 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 that on day -1. The variable *ABVOL*(-5, -1) is the stock's abnormal volume in the preannouncement period, measured as the average daily volume in the pre-announcement period divided by the average daily volume in one no announcement year window (-266, -11), all minus 1. 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 in bracket below the coefficients. (***), (**) and (*) indicate significance at 1%, 5%, and 10% levels, respectively.

	Model B.1 Regression (1)	Model B.2 Regression l (2)		Model B.3 Regression (4)	Regression (5)
	Reg. SHO	Reg. SHO	Regression (3) Prior to 2003	Post to 2003	Reg. SHO
Holding	-0.285	0.049	-0.838	-1.03	-1.665*
	[-0.27]	[-0.76]	[-0.79]	[-1.40]	[-1.71]
Stock×Holding	4.003**	0.286**	0.483	1.850**	2.057*
	[-2.17]	[-2.26]	[-0.14]	[-2.37]	[-1.76]
RET(-5,-1)	1.189	0.228*	1.167	-2.028***	-2.777*
	[-0.55]	[-1.85]	[-0.68]	[-2.66]	[-1.86]
ABOVL(-5,-1)	0.048***	---	0.005	0.000	0.007
	[-3.16]	---	[-0.22]	[-0.01]	[-0.37]
NORMRELSS	---	0.906***	---	---	---
	---	[-8.97]	---	---	---
ABOPTVOL(-5,-1)	---	---	0.000*	0.000***	0.000***
	---	---	[-1.92]	[-5.40]	[-4.64]
Constant	0.432***	0.019	-0.006	0.017	0.086
	[-5.1]	[-0.86]	[-0.02]	[-0.42]	[-1.30]
N	277	277	209	401	221
Adj. R^2	0.057	0.31	-0.017	0.29	0.295

TABLE VIII: Multivariate Analysis of Abnormal Short Selling by Level of Short-term Hedge Fund Holdings

$$ABSS(-5,-1) = \beta_0 + \beta_1 RET(0,+1) + \beta_2 RET(0,+1) \times Abv.Median + \beta_3 RET(-5,-1) + \beta_4 ABVOL(-5,-1) + \varepsilon \quad (C.1)$$

$$RELSS(-5,-1) = \gamma_0 + \gamma_1 RET(0,+1) + \gamma_2 RET(0,+1) \times Abv.Median + \gamma_3 RET(-5,-1) + \gamma_4 NORMRELSS + \varepsilon \quad (C.2)$$

$$ABLongPut(-5,-1) = \delta_0 + \delta_1 RET(0,+1) + \delta_2 RET(0,+1) \times Abv.Median + \delta_2 RET(-5,-1) + \delta_3 ABVOL(-5,-1) + \delta_5 ABOPTVOL(-5,-1) + \varepsilon \quad (C.3)$$

This table presents the results of OLS estimation of above equations, as fitted to the full sample and 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 1. 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 net long put option 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 that on day -1. The variable *ABVOL*(-5, -1) is the stock's abnormal volume in the preannouncement period, measured as the average daily volume in the pre-announcement period divided by the average daily volume in one no announcement year window (-266, -11), all minus 1. 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). An acquirer is considered in below (above) median group if the short-term hedge fund holding of its target is below (above or equal to) the median of the distribution of all takeover acquirer firms 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* (1)**							
Rank by short term Hedge fund Holdings	β_0	β_1	β_2	β_3	β_4		*Adj.* R^2
All	0.451***	-0.727		1.331	0.048***		0.049
[n=277]	[-7.03]	[-0.85]		[-0.62]	[-3.14]		
All	0.453***		-2.288*	1.261	0.049***		0.056
[n=277]	[-7.1]		[-1.92]	[-0.59]	[-3.18]		
≥ Median	0.462***	-2.506**		-1.442	0.057***		0.067
[n=146]	[-5.46]	[-2.23]		[-0.67]	[-3.37]		
< Median	0.451***	1.127		4.737	0.039**		0.065
[n=131]	[-4.45]	[-0.83]		[-1.30]	[-2.17]		
***Panel B*: *Equation* (2)**							
Rank by short term Hedge fund Holdings	γ_0	γ_1	γ_2	γ_3	γ_4		*Adj.* R^2
All	0.014	-0.229***		0.225*	0.941***		0.326
[n=277]	[-0.65]	[-3.28]		[-1.78]	[-9.49]		
All	0.013		-0.324***	0.224*	0.953***		0.328
[n=277]	[-0.59]		[-3.1]	[-1.77]	[-9.57]		
≥ Median	-0.015	-0.322***		0.279	1.104***		0.377
[n=146]	[-0.44]	[-3.11]		[-1.53]	[-7.39]		
< Median	0.038	-0.174		0.169	0.797***		0.278
[n=131]	[-1.38]	[-1.64]		[-1.07]	[-6.66]		
***Panel C*: *Equation* (3)**							
Rank by short term Hedge fund Holdings	δ_0	δ_1	δ_2	δ_3	δ_4	δ_5	*Adj.* R^2
All Sample Prior to 2003							
All	0.076	2.843		1.61	0.007	0.000***	0.010
[n=209]	[0.576]	[1.127]		[0.890]	[0.316]	[3.872]	
All	-0.016		1.391	1.398	0.006	0.000***	0.002
[n=209]	[-0.072]		[1.060]	[0.815]	[0.286]	[3.756]	
≥ Median	-0.025	1.214		-0.29	0.01	0.000***	0.110
[n=102]	[-0.348]	[1.439]		[-0.626]	[1.165]	[5.394]	
< Median	0.183	4.833		4.405	-0.007	0.000**	0.000
[n=107]	[0.704]	[0.951]		[0.945]	[-0.116]	[2.605]	
All Sample Post to 2003							
All	-0.066*	-0.687		-1.886**	-0.007	0.000***	0.274
[n=401]	[-1.839]	[-1.584]		[-2.477]	[-0.668]	[5.516]	
All	-0.063*		-1.035*	-1.848**	-0.007	0.000***	0.275
[n=401]	[-1.766]		[-1.662]	[-2.442]	[-0.684]	[5.519]	
≥ Median	-0.126**	-1.357*		-1.878	-0.007	0.000***	0.212
[n=201]	[-2.032]	[-1.891]		[-1.468]	[-0.401]	[3.122]	
< Median	-0.009	-0.004		-1.711**	-0.005	0.000***	0.426
[n=200]	[-0.254]	[-0.008]		[-2.303]	[-0.584]	[6.556]	
All Sample in Regulation SHO Period							
All	-0.07	-1.580**		-2.522*	0	0.000***	0.280
[n=221]	[-1.240]	[-2.049]		[-1.753]	[-0.008]	[4.419]	
All	-0.059		-2.650*	-2.485*	0.001	0.000***	0.282
[n=221]	[-1.070]		[-1.915]	[-1.725]	[0.036]	[4.438]	
≥ Median	-0.194**	-3.259**		-3.401	-0.005	0.000**	0.234
[n=114]	[-1.994]	[-2.034]		[-1.240]	[-0.144]	[2.580]	
< Median	0.06	0.064		-1.175	0.004	0.000***	0.519
[n=107]	[1.213]	[0.090]		[-1.353]	[0.278]	[5.341]	

Table IX: Short-term Hedge Fund Stakes and Abnormal Short Sale sorted by Target Premium

Panel A consists of all completed and withdrawn M&A deals during the period January 3, 2005–July 6th, 2007. We sort all deals into High (above median) and Low (below median) groups based on target premium as measured by the Fama & French and momentum 4-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(-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 1. Short Term Hedge Fund Stakes is hedge fund holding on Target, and Qtr(-1) and Qtr(0) represents the one quarter prior to the announcement and announcement quarter respectively. Panel B reports the univariate results for the subsample for the deals with positive short term hedge funds only. 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, respectively.

	All Deals			Stock Deals		
	Low	High		Low	High	
Panel A: Whole Sample						
Target Premium	3.19%	48.09%	***	-5.18%	49.31%	***
	[6.36%]	[41.76%]	***	[-0.10%]	[38.83%]	***
Short Term Hedge Fund Stakes Qtr(-1)	3.98%	6.27%	**	3.02%	4.28%	
	[2.05%]	[3.24%]	*	[1.84%]	[3.31%]	
Change Short Term Hedge Fund Stakes Qtr(0)-Qtr(-1)	-1.58%	-3.25%	**	-0.60%	-2.38%	
	[-0.30%]	[-0.64%]	**	[-0.03%]	[-0.25%]	
Abnormal Short Sale (-10, -1)	34.98%	48.09%		45.38%	62.23%	
	[4.18%]	[22.54%]	**	[11.50%]	[36.25%]	
Abnormal Profit from Shorting (Acquirer) (-5,5)	-20,082.43	-13,193.60		-98,840.04	-70,641.46	
	[-2,043.32]	[3,064.62]	**	[-2,121.21]	[1,633.51]	
Abnormal Profit from Shorting (Acquirer) (-10,10)	68,169.02	-24,254.47		-95,656.85	-121,093.37	
	[-2,074.89]	[1,521.97]	**	[-2,752.00]	[2,916.74]	
OBS.	159	160		43	44	
Panel B: Subsamples with Positive Short-term Hedge Fund stakes						
Target Premium	3.88%	48.17%	***	-5.03%	52.29%	***
	[7.78%]	[42.70%]	***	[0.39%]	[40.16%]	***
Short Term Hedge Fund Stakes Qtr(-1)	4.68%	7.09%	**	3.77%	4.92%	
	[2.42%]	[3.96%]	*	[2.38%]	[3.89%]	
Change Short Term Hedge Fund Stakes Qtr(0)-Qtr(-1)	-1.89%	-3.66%	**	-0.74%	-2.81%	
	[-0.55%]	[-1.02%]	**	[-0.29%]	[-1.32%]	
Abnormal Short Sale (-10, -1)	33.42%	45.25%		44.10%	59.13%	
	[7.50%]	[21.61%]	*	[12.20%]	[40.61%]	
Abnormal Profit from Shorting (Acquirer) (-5,5)	-32,463.30	-7,722.32		-120,934.61	-86,108.40	
	[-2,748.21]	[4,766.48]	**	[-17,466.40]	[4,125.55]	
Abnormal Profit from Shorting (Acquirer) (-10,10)	65,184.22	-17,504.38		-112,028.09	-153,985.43	
	[-3,828.59]	[1,764.72]	*	[-11,777.70]	[2,259.74]	
OBS.	139	139		36	37	

Table X: Target premium and Abnormal Profit from Shorting by double sorting on Short Selling and Short Term HF Stakes

This Table consists of all completed and withdrawn M&A deals with positive short-term hedge fund stakes 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 holding in the quarter prior to the M&A announcement. Deals within each group are then assigned into above median and below median classes based on Abnormal Short Sale 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 stakes subsamples) and in the High-High (above median class for both abnormal short selling and short-term hedge fund stakes subsamples) groups. The target premium is measured by the Fama & French and momentum 4-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 1. 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 $sale_{-10}$ *($Price_{-10}$-$Price_1$) + Abnormal short $sale_{-10}$ *($Price_{-10}$-$Price_2$) + … + Abnormal short $sale_{-10}$ *($Price_{-10}$-$Price_{10}$))· 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	
Abnormal Short Sale (acquires) (-10, -1)	-39.34%	105.73%	***	-37.06%	161.08%	***
	[-37.86%]	[76.49%]	***	[-31.91%]	[119.41%]	***
Short Term HF Stakes (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	