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By

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Abstract

Do Managers Exploit Private Information about Their Firm's Investor Base?

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Doctor of Philosophy in Business Administration

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Professor Omri Even-Tov, Chair

I investigate whether managers obtain and exploit private information about who is buying and selling their firm's securities. To do so, I examine insider trading prior to activist investors' disclosure of Schedule 13Ds. Schedule 13Ds are required when investors have acquired more than 5% of a firm's shares, and they cause a significant price jump of approximately 6% upon disclosure. I find that insider purchases (sales) are abnormally high (low) in the days prior to the disclosure of Schedule 13Ds. Cross-sectionally, pre-disclosure insider purchases are higher when activist investors make larger trades, since they are more likely to be detected by insiders. Furthermore, the stock market fails to recognize that insiders trade ahead of the Schedule13D filings, reflected by the fact that pre-disclosure insider trading does not facilitate price discovery in the underlying firms. Finally, I show that pre-disclosure insider trading is predictive of the firm's future stock and operating performance, consistent with managers exploiting private information when they expect it to generate greater profits. Taken together, my results show that managers obtain private information concerning their firm's investor base and exploit it for personal gain.

This dissertation is dedicated to my husband, Hao Yang, Ph.D. As a material science researcher, he managed to read daily news on Bloomberg, WSJ, as well as follow earnings calls, and share important news with me. And thanks to his enthusiasm in the financial world, my dissertation idea was originated from an interview video with Warren Buffett that he shared with me. His curiosity and energy have inspired me. And his support, encouragement, and constant love have sustained me throughout the ups and downs of the doctorate program.

I dedicate this dissertation to my son Mark S. Yang, who I had during my fourth year of doctorate program. Mark constantly reminds me that happiness can be simple, and his happy face keeps me moving.

I also dedicate this work to my mom Xiaozhen Tang, my dad Liwen Zeng, and my mother-in-law Mingli Liu for supporting my family so much during the doctorate program.

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"…There are some stock watch firms. I don't even know their names, I don't know how many there are but a lot of big companies use them…and they report to management who they think is buying and selling…I think it would be very interesting just to know who they are, how much they charge, how they get their information, because we've had that happen four to five times…"

-Quoted from Warren Buffett's interview with CNBC on 05/05/2017

1. Introduction

A growing body of literature shows that executives of public firms devote a considerable amount of time initiating and tending to private interactions with shareholders (e.g., Bushee et al., 2017; Bushee et al., 2018; Solomon & Soltes, 2015). These investor relations (IR) efforts amplify the firm's investor recognition, analyst and media coverage, liquidity, and market value (Bushee & Miller, 2012; Green et al., 2014; Kirk & Vincent, 2014). However, their attempts to reach investors are often inhibited because the majority of public firms' shares are held "in street names" by brokers and banks on behalf of their beneficial owners, whose identities are concealed.[1] To mitigate this information asymmetry, the SEC requires investors to publicly disclose their holdings through filing either a Schedule 13D or 13G if they accumulate more than 5% of a firm's shares, or through filing Forms 13F, N-CSR, or N-Q on a quarterly basis.[2] However, because such public filings are infrequent, delayed, and poorly enforced, they are of limited use in picturing real-time share transactions.[3]

In this study, I investigate whether managers obtain and exploit private information regarding their firm's investor base. This is a significant issue because ownership information influences stock market prices, and managers' advantage in this arena may affect their behaviors and their firm's operating policies.

Anecdotal evidence suggests that managers obtain superior information regarding their firm's investor base beyond that disclosed in public filings. For example, in 2017, Warren Buffett indicated surprise when IBM's CEO learned that Buffett had sold IBM

[1] According to Investopedia, "in street name" is a slang term used to describe a brokerage that holds securities on behalf of a client. The name that appears on the stock or bond certificate is that of the broker, even though the person who pays for the securities retains all ownership rights. An estimated 70 to 80% of shares are held under "in street names," and only 20 to 30% of shares are registered directly under the ultimate beneficial owners' names.

[2] Previous studies document that ownership disclosures are informative to the stock market. See Brav et al. (2008) on Schedule 13D; Agarwal et al. (2013) on confidential Form 13F; Brown and Schwarz (2013) on Form 13F; and Agarwal et al. (2015) on mutual funds disclosures.

[3] 13F forms, the most common ownership disclosures, are only required to be filed within 45 days after the quarter-end. For example, a share transaction that occurred on January 1, 2019 would not need to be disclosed until May 15, 2019. In addition, there is little enforcement of these ownership disclosures. Notably, 30% of Schedule 13Ds were filed after the regulatory deadline. Lastly, investors might deliberately structure themselves as a group of smaller funds to avoid triggering disclosure requirements.

shares before he had even filed the public disclosure.[4] Additionally, a 2007 joint survey performed by CFO.com and the National Investor Relations Institute (NIRI) revealed the existence of stock-surveillance firms that specialize in tracking stock trading data for management, and indicated that over 50% of public firms use such services to monitor their investor base.[5] Instead of relying on public disclosures, public firms have shifted to utilizing these stock-surveillance services and making direct contact with investors to obtain ownership information.[6] This evidence suggests that public companies and their executives are attempting to bypass the limitations of public disclosures to learn about their investor base. The information they gain by doing so can be leveraged for various ends, such as building better relations with investors or preparing for potential activist threats or hostile bids.[7]

To examine whether managers possess and exploit private information of their firm's ownership changes, I focus on disclosures of Schedule 13Ds. Rule 13d-1(a) requires investors to file with the SEC within 10 days of acquiring more than 5% of any class of securities of a publicly traded company if they have an interest in influencing the company's management. The disclosure of Schedule 13Ds results in an average abnormal stock return of about 6% in the (t - 10, t + 10) window around the filing date and about 3% in the (t - 1, t + 1) window around the filing date, consistent with prior studies (e.g., Brav et al., 2008; Clifford, 2008; Greenwood & Schor, 2009). These studies suggest that the positive returns likely reflect Schedule 13D filers' revelation of target firms' undervaluation and their intervention to enhance targets firms' values. Using the 13D filing setting, I propose that if managers possess private information regarding their investor base (e.g., purchases of Schedule 13D filers), they will strategically trade prior to the public disclosure of Schedule 13Ds in order to benefit from the associated price increase.

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[4] See CNBC's interview with Warren Buffett: https://www.cnbc.com/2017/05/04/warren-buffett-has-revalued-ibm-downward-cites-big-strong-competitors.html

[5] According to a 2007 survey by CFO.com and the National Investor Relations Institute (NIRI), more than 50% of Investor Relation officers (IROs) use stock-surveillance services to monitor their investor base and more than 94% believe that information provided by stock-surveillance services is at least somewhat accurate. Please see the survey results presented in Appendix 1. A more recent 2014 survey by Rivel indicates that 64% of public firms use a stock-surveillance vendor, including 83% of large-cap, 66% of mid-cap and 44% of small-cap companies.

[6] In a 2015 Activist Investor Survey by NIRI, IROs were asked how they first learn of activist investors' involvement. Twenty percent of IR professionals learn through public SEC filings, 20% are informed through stock-surveillance firms, and 49% find out through direct contact by activist investors. Please see the survey results presented in Appendix 1. Note that while companies also learn about their investor base through direct contact with investors, this source might not useful in identifying when and how much these investors are trading in the company's stock, so a likely scenario is that these two sources are corroborated and supplemented by one another.

[7] See the following related articles: Randall Smith "'Stock watch services thrive" available at: https://www.wsj.com/articles/SB115551994704734777; Kate O'Sullivan "Who owns your stock?" available at: https://www.cfo.com/risk-compliance/2007/10/who-owns-your-stock/; Susan Pulliam "SEC probes firms that gather data on who owns what shares" available at https://www.wsj.com/articles/SB110247556985994158.

I construct a comprehensive sample of 2,087 Schedule 13Ds filed between 2002 and 2016. Figure 1 presents the timeline of my research design. I denote the date on which Schedule 13D filers cross the 5% threshold as the trigger date (TD) and the date of disclosure as the filing date (FD).[8] Following Lie (2005) and Dechow et al. (2016), I compare the level of insider purchases and sales of target firms over the pre-disclosure period prior to the filing date to that of control period observations. Control period observations are comprised of five observations from the same target firms with event dates selected randomly from the available trading days between 3 to 6 months before or after the filing of Schedule 13Ds. Throughout the study, I measure daily insider purchases (sales) as the daily fraction of shares outstanding purchased (sold) by insiders measured in basis points. I measure daily insider net purchases as daily insider purchases minus daily insider sales.

My results are consistent with opportunistic insider trading prior to the public disclosure of Schedule 13Ds. I find that relative to random control periods, target firms' insiders sell 33% (36%) less shares between days -20 to -11 (days -10 to -6) prior to the trigger date and purchase 63% (147%) more shares over the five days just before the trigger date (over the intermediate period between the trigger date and filing date). In comparison, I do not discover significant differences in other time windows immediately prior to the filing date. These results indicate that insiders avoid selling when they have vague information and are unsure whether the Schedule 13D filer will eventually cross the 5% threshold, and only begin to aggressively purchase their own stock when they learn more details about the filer's purchases. The results hold in regression analyses when controlling for other determinants of insider trading.

Next, I examine whether the level of pre-disclosure insider trading is higher in cases where Schedule 13D filers' trades are more likely to be detected by stock-surveillance firms. Private conversations with stock-surveillance firms suggest that it is easier to detect an investor's identity when they make larger trades. Hence, I predict that larger trades that a Schedule 13D filer makes to accumulate 5% ownership, the easier it will be for the stock-surveillance firm to detect their identity, which will result in a higher likelihood of insiders' engagement in abnormal (net) purchases in the pre-disclosure period.[9] To test this theory, I hand-collect Schedule 13D filers' daily trades executed during the 60 calendar days that precede the filing date as reported in Item 5(c) on Schedule 13Ds, and compute the number of trading days that filers trade over the 60-day period. The results are consistent with my prediction and suggest that the more quickly Schedule 13D filers accumulate 5% ownership, the easier it is for their trades to be detected by stock-surveillance firms, which subsequently results in a higher level of pre-disclosure insider trading.

I attribute my results to insiders' accrual of private information on investors' buys and sells. However, there are two potential alternative explanations: (1) "reverse

[8] Note that the trigger date is private until the disclosure of Schedule 13Ds.The trigger date is disclosed on the first page of Schedule 13D filings, and I extract it based on an automatic script.

[9] Throughout the study, I refer to the pre-disclosure period as the period between day TD-20 and day FD-1, if not specified otherwise.

causality," which would speculate that Schedule 13D filers base their trades on insiders' abnormal trades; or (2) that both Schedule 13D filers and insiders trade based on private information of target firms' undervaluation. Under the first explanation, reverse causality predicts that insiders trade *before* Schedule 13D filers since Schedule 13D filers should have observed abnormal insider trading when they conducted their trades. Under the second explanation, private information predicts that insiders would trade evenly across the period when Schedule 13D filers accumulate their shares. This is because the firm's state of being undervalued is unlikely to change over a short period of time. However, my findings reveal that insiders start to opportunistically purchase more at trading day -5 prior to the trigger date, whereas the average Schedule 13D filer has already accumulated a significant number of shares: 4.3% at trading day -5 prior to the trigger date. These results are inconsistent with both of the alternative explanations.

To further refute the two alternative explanations, I focus on the days that Schedule 13D filers make large trades and compare insider trading over the five-day window before and after this activity. If insiders trade on private information of Schedule 13D filers' purchases, then I would expect to observe a higher level of insider (net) purchases post-large trades by Schedule 13D filers. In contrast, under the reverse causality explanation (that Schedule 13D filers base their trades on insiders' abnormal trades), I would expect a higher level of insider (net) purchases in the pre-large trade window. Further, under the private information explanation (where both parties trade on private information of target firms' undervaluation), I would expect a similar level of insider trading in the post- and pre- window, since the firm's fundamental performance is unlikely to change over such a short period of time. Consistent with my hypothesis that insiders trade on private information of Schedule 13D filers' purchases, I document that insider (net) purchases are significantly higher during the post-window than the pre-window. Therefore, my hypothesis provides an explanation for the results that cannot be explained by the two alternative explanations.

After establishing that insiders opportunistically trade prior to the disclosure of Schedule 13Ds, I quantify how much they profit from their trades. For the 242 target firms with insider purchases over the pre-disclosure period of (TD-20, FD-1), insiders make average purchases of $190,931 and earn an average of $49,400 per Schedule 13D event, which is equal to a return of 26% in about 30 trading days (over 300%, annually). Note that insiders can earn profits directly by engaging in purchases or indirectly by ceasing to sell their stocks. I rely on the summary statistic of net purchases and estimate the profits for 757 target firms with (positive) abnormal insider net purchases over the pre-disclosure period. The average abnormal insider net purchases are $1,204,059, and I estimate that insiders earn profits of at least $43,193 per Schedule 13D event. Thus, the size of the profit is approximately equal to the average annual wage of a US worker ($48,672 in 2019), suggesting that the profits are not only of statistical significance, but also of economic significance.[10]

[10] See, https://www.bls.gov/news.release/pdf/wkyeng.pdf

Next, I examine whether the stock market recognizes that insiders possess private information of Schedule 13D filers' purchases. Given that insiders are required to report their trades within two business days, if the stock market does indeed recognize that these trades reflect managers' private knowledge of upcoming Schedule 13Ds, I would expect target firms with pre-disclosure abnormal insider trading to experience a higher price run-up and lower returns upon such disclosures. However, the null results suggest that the market does not differentiate between Schedule 13Ds with and without abnormal insider net purchases. These results suggest that investors are unaware of the insider trading and that the insider trading does not facilitate price discovery of target firms prior to the public disclosure of Schedule 13Ds.

Finally, I explore whether the pre-disclosure abnormal insider trading is associated with future target firms' future stock and operating performance. I find that target firms with abnormal pre-disclosure insider (net) purchases earn an 8.3% higher return over the 120 trading days following the filing date, and have higher growth in total assets, revenue, ROA, and leverage in the subsequent year. These results suggest that (i) managers are more likely to exploit their private information when they believe that Schedule 13D filers will add value to their companies; or (ii) insiders who believe their companies are undervalued are more confident to purchase additional shares in their company when they have corroborating evidence of undervaluation (i.e., another investor secretly purchasing a large holding in their company).

My paper makes several contributions to the literature. First, to the best of my knowledge, this is the first empirical study to provide evidence consistent with managers obtaining private knowledge of their firm's investor base. Second, my study highlights that an important part of investor relations programs appears to be monitoring the firms' investor base. Prior research documents that firms benefit from investor relation (IR) programs, by improving information disclosures, attracting institutional investors, improving analyst and media coverage, and directing access to management (Bushee & Miller, 2012; Chapman et al., 2018; Kirk & Vincent, 2014). The results of my study suggest that by monitoring a firm's investor base, investor relation officers are better able to target who they need to please and what future demands are likely to be. However, my study also reveals that the benefits of this surveillance, also comes at a potential cost to shareholders, since it gives managers a potential trading advantage.

My study adds to the literature on strategic insider trading in two ways. It contributes to the line of research that examines insider trading before the disclosure of various corporate events, including bankruptcy (Seyhun & Bradley, 1997), mergers and acquisitions (Agrawal & Nasser, 2012), seasoned equity offerings (Kahle, 2000; Karpoff & Lee, 1991), stock repurchases (Lee et al. 1992), break in earnings string (Ke et al. 2003), 10-K and 10-Q filings (Huddart et al. 2007), management forecasts (Cheng & Lo 2006; Noe 1999), earnings announcements (Cohen et al. 2012), and revenue comment letters (Dechow et al. 2016). My study is the first to examine strategic insider trading before ownership disclosures, particularly before the disclosure of Schedule 13Ds. The

disclosure of Schedule 13Ds is a distinct event because (1) Schedule 13Ds are disclosed by the investor (not the corporation) and (2) insiders possess superior but not perfect information of Schedule 13D filers' purchases, and thus the litigation risk of trading on it is likely to be low. These findings should be of interest to regulators who build models to identify situations that arouse suspicion of improper insider trades.

Finally, early insider trading studies (e.g., Lakonishok & Lee, 2001; Piotroski & Roulstone, 2005; Rozeff & Zaman, 1998; Seyhun, 1992) show that insiders are contrarian investors: they trade against current investor sentiment. My study demonstrates that insiders can and do follow sophisticated investors' trades. Additionally, I show that pre-disclosure insider trading can help to forecast target firms' future stock and operating performances, suggesting that insiders follow sophisticated investors if they believe that Schedule 13D filers are adding value to their companies or they agree with their assessments regarding undervaluation. These findings should bear relevance for investors and market analysts who seek to infer price-relevant information from insiders' trades.

2. Background of monitoring investor base

Anecdotal evidence suggests that managers actively monitor trading activities in their firm's stocks, thereby gaining a substantial information advantage over other market participants. A 2007 CFO/NIRI survey indicates that as many as 94% of public firms monitor changes in their investor base and that 57% subscribe to external stock-surveillance services.[11] In 2015 NIRI conducted an activist investor survey to discern how most IROs first learn of activist investors' involvement. They discovered that only 20% of IR professionals find out through public SEC filings and 80% of IR professionals find out through private sources, and two important sources that managers consult to gather non-public information of trading activities in their firm's stocks are (1) external stock-surveillances and (2) ongoing discussions with their investors. Note that while companies also learn about their investor base through direct contact with investors, this source might not useful in identifying when and how much these investors are trading in the company's stock, so a likely scenario is that these two sources are corroborated and supplemented by one another. Significantly, these sources are largely inaccessible to other market participants because trading investors often choose to disguise their trades and because stock-surveillance services only serve public firms.

Notable stock-surveillance services providers include or included (but are not limited to) Ipreo, CapitalBridge, Q4 Web Systems, Ilios Partners and Thomson Financial. The industry arose during the corporate takeover battles of the 1980s. Proxy-solicitation firms were hired to identify shareholders and appeal to them for their votes. In the early 1990s, some proxy-solicitation firms began to build a business around stock monitoring and marketed their services to public firms who wanted to ascertain the identity of their shareholders. The stock-surveillance business has grown since then, partly fueled by the upsurge in shareholder activism.

To perform their service, these firms obtain bits of trading information from legitimate sources,[12] then connect the dots and fill in the blanks through market analysis and data analytics to identify buyers and sellers. One essential data source that stock-surveillance firms utilize is the Depository Trust Company & Clearing Company's ("the DTC") daily report of where shares are held in custody by which custodian banks

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[11] A more recent 2014 survey by Rivel indicates that 64% of public firms use a stock-surveillance vendor, including 83% of large-cap, 66% of mid-cap and 44% of small-cap companies.

[12] Although the stock-surveillance firm business model is legitimate, the SEC has probed the ethical standards of their analysts in the past. See Susan Pulliam "SEC probes firms that gather data on who owns what shares," which reports on allegations of firms offering systematic gratuities to custodian banks' employees for leaking confidential data, available at https://www.wsj.com/articles/SB110247556985994158.

(referred to as the 'DTC data').[13] [14] Public firms are entitled of the access to the DTC data and they may also turn over such reports to third parties, such as stock-surveillance firms. Therefore, stock-surveillance firms won't be able to figure out shareholders' identities without the underlying public firm's approval. The DTC report serves as a road map for stock-surveillance firms, and they combine the listings with several other sources: a proprietary database containing information regarding which custodian banks the suspected investors use, regulatory filings, and data regarding significant investors' investment strategies. If public firms want up-to-the-minute news of their shares' buyers and sellers, stock-surveillance firms may turn to various market contacts, including the stock exchange, money managers, trading desks, and other Wall Street participants, for more specific information regarding a given day's trading activity. In most instances, the bits of trading information they obtain and collate seem sufficient to determine conclusively the identity of those buying or selling shares.

[13] The DTC lists give only the total number of a company's shares held at each custodian bank and do not provide data about specific investors' holdings or other sensitive information. Check the DTC's website for more detailed information at http://www.dtcc.com/settlement-and-asset-services/issuer-services/security-position-reports. The DTC provides clearance and settlement services to the financial market, and investors are required to settle their security transactions within three business days of the trade date. It's the so-called "t +3" settlement cycle, which stands for "trade date plus three days." To better understand how the settlement system works, see the SEC memorandum at https://www.sec.gov/reportspubs/investor-publications/investorpubstplus3htm.html.

[14] For instance, when a pension or mutual fund buys shares, it places the order with a broker, who goes to a stock marketplace to have the order matched with a seller. After the order is filled, the fund sends instructions to the broker about where to deliver the shares and which custodian bank will make payment for them. The fund also sends instructions to that custodian bank, telling it to receive the shares and pay the broker. Both the broker and the custodian bank send instructions about the trade to the DTC. The DTC is part of a private organization established in the 1970s to formally process and make final the trades—steps known as "settlement" and "clearing," respectively—for the bulk of the U.S. stock trading. The DTC formally moves ownership of the shares to the buyer and sends payment for the trade through one of the Federal Reserve banks. This is the final step in a process that can take up to three days to complete.

3. The setting of Schedule 13Ds

The current rules governing investors' disclosure of ownership and holdings consist of five overlapping parts: Schedule 13D for large (above 5%) active shareholders, Schedule 13G for large (above 5%) passive shareholders, Form 13F for quarterly disclosure of holdings required for institutional investment managers, Forms N-CSR and N-Q for quarterly or semiannual disclosure of holdings required for mutual funds, and Section 16 for ownership by insiders.[15] While these public filings offer only partial snapshots of public firms' ownership structures,[16] previous studies document the impact of Schedule 13D, confidential Form 13F, and Form 13F on the stock market, respectively (Agarwal et al., 2013; Agarwal et al., 2015; Brav et al., 2008; Brown & Schwarz, 2013).

Among the five regimes, Schedule 13Ds have two unique properties: their disclosure has the highest price impact (Brav et al., 2008; Collin-Dufresne & Fos, 2015; Greenwood & Schor, 2009) and investors disclose their daily stock transactions therein. These aspects are essential to determine whether managers of public companies trade based on foreknowledge of their companies' shareholder ownership changes. Thus, in this study, I focus on their disclosure and examine a sample of 2,087 Schedule 13Ds.

Under Section 13(d) of the 1934 Exchange Act, investors acquiring more than 5% of any class of securities of a publicly traded company are required to file with the SEC within 10 days if they intend to influence the company's management. Figure 1 presents

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[15] Here, I discuss the detailed requirements for each of the ownership disclosures. Irrespective of their asset base, under the terms of Exchange Act Section 13(d), any investor acquiring beneficial ownership of more than 5% of a class of a company's registered equity securities must disclose such information within 10 days of the transaction by filing a Schedule 13D with the SEC. A 5% owner may file a more abbreviated Schedule 13G and avoid disclosure of purpose or intentions if they acquired the securities in the ordinary course of business and without the purpose or effect of changing or influencing the control of the issuer. In contrast, passive institutional investors that acquire more than 5%, but less than 10%, of the company's stock and do not intend to influence control of the target company, but rather are merely investing in the ordinary course of business, must file a Schedule 13G within 45 days of the end of the calendar year in which they cross this ownership threshold. Those passive investors accumulating more than 10% of the stock must file within 10 days after the end of the first month that they exceed ten percent. Alternatively, any person who would otherwise be obligated to file a Schedule 13D may file a Schedule 13G if they do not intend to change control of the issuer and do not hold more than 20% of the issuer's stock. Section 13(f) of the 1934 Securities Exchange Act requires all institutional investment managers who have investment discretion over $100 million or more in Section 13(f) securities to disclose their aggregate holdings (at the company level) on a quarterly basis in Form 13F, with no more than a 45-day delay. The Investment Company Act of 1940 mandates that individual mutual funds disclose their portfolio holdings quarterly in Forms N-CSR and N-Q, with a delay of no longer than 60 days. Exchange Act Section 16 requires insiders (that is, all directors, executive officers, and beneficial owners of more than 10% of any registered class of equity security of an issuer) to report that person's beneficial ownership and transactions in such securities.

[16] First, these public filings are infrequent and untimely. For example, per Form 13F, the most common ownership and holding disclosure, all institutional investors who have investment discretion over $100 million in Section 13(f) securities are only required to disclose their quarter-end holdings in these securities within 45 days of the quarter's end. As such, if a public firm's ownership information is extracted on May 14, 2019, most likely the numbers sourced from Form 13Fs will only reflect institutional investors' holdings as of December 31, 2018..

the timeline of a typical Schedule 13D. I refer to the date when the Schedule 13D filer crosses the 5% threshold as the "trigger date" (denoted as "TD") and the date on which the Schedule 13D is filed with the SEC as the "filing date" (denoted as "FD"). In my sample, the median number of days between trigger date and filing date is nine calendar days.

Previous research consistently documented significant positive returns surrounding the filing of Schedule 13Ds (e.g., Brav et al., 2008; Collin-Dufresne & Fos, 2015; Greenwood & Schor, 2009) and found that these positive returns do not reverse in the subsequent year (Brav et al., 2008; Greenwood & Schor, 2009). Similar to these studies, I plot the average abnormal buy-and-hold return of target firms and the abnormal trading volume from 20 days prior to the trigger date to 20 days after the filing date. As shown in Figure 2, there is an average run-up of 2.9% between the trigger date and the filing date. The filing day and the following five days see a jump of 2.7%, after which the excess keeps trending up to a total return of 6.1% at day 20 after the filing date.[17] There is no evidence of reversal if I extend the window over the subsequent six months. Notably, the price run-up begins precisely on the trigger date, alongside a spike in abnormal trading volume. The abnormal trading volume on the trigger date likely reflects (1) Schedule 13D filers' aggressive purchases on the date when they cross the 5% threshold, (2) the presence of wolf-packing (Wong, 2017), and (3) information leakage via the Schedule 13D filer's primary broker (Maggio et al., 2019).

Based on the above data, it remains uncertain what spurs the positive abnormal returns upon disclosure of Schedule 13Ds. Do the returns simply reflect the revaluation of undervalued firms or can they be attributed to value creation by Schedule 13D filers? A few studies focus on a subsample of hedge fund activism[18] and argue that the abnormal returns go beyond simply stock picking of undervalued firms to reflect market expectation of Schedule 13D filers' intervention (i.e., Schedule 13D filers create value). For example, Brav et al. (2008) find that Schedule 13D filings lead to improvements in total payout and a return on assets and operating margins. Brav et al. (2015) utilize plant-level data from the U.S. Census Bureau and learn that target firms improve production efficiency after activist intervention. Greenwood and Schor (2009) and Boyson et al. (2017) conclude that activist hedge funds increase the probability of target firms' acquisition in the future. Furthermore, the information that Schedule 13D filers trade on seems long-lived: Brav et al. (2008) document that the median duration from the first Schedule 13D filing to Schedule 13D filer's "exit" is 369 days.[19]

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[17] The average buy-and-hold returns surrounding the filing of Schedule 13Ds display similar patterns across the subsamples that are initiated by hedge funds and non-hedge funds.

[18] My study includes all Schedule 13D filings, while Brav et al. (2008), Brav et al. (2015), Greenwood and Schor (2009) and Boyson et al. (2017) consider only filings by hedge funds that have explicitly stated their intentions to influence management.

[19] Brav et al. (2008) define exit date as the point at which the hedge fund's holding in the target company drops below 1%, or $1 million. When such information is not available, they define the exit date as the hedge fund's last Schedule 13D/A filing date when its ownership drops below the 5% threshold.

4. Main hypothesis

The anecdotal evidence discussed in Section 2.1 suggests that managers possess private information of the identity of those buying and selling their companies' stocks. Given these findings, I hypothesize that managers are aware of Schedule 13D filers' accumulation of their companies' stocks before public disclosure via Schedule 13Ds, and I further propose that managers will trade to take advantage of this information.

Managers have several motives to trade prior to the filing of Schedule 13Ds. First, they may want to profit from the positive market reaction upon the filings' disclosure. Second, they may trade as a defense mechanism to ward off unwanted investors. Third, managers may accelerate future trades in order to act before the filing of Schedule 13Ds, in case they trade based on a similar information set as Schedule 13D filers (e.g., expectations of target firms' future performance), given that they know that such information will be disclosed at the filing of Schedule 13Ds. The interaction between insiders and other types of "informed" investors has been examined in the literature. For example, Holden and Subrahmanyam (1992) examine strategic behaviors in a setting of multiple informed traders and suggest that the presence of other informed investors acts as a stimulus for insiders to trader sooner and faster. Additionally, a recent paper by Massa et al. (2015) postulates the idea of trading competition and finds that the presence of short sellers induces insiders to trade at an increased and faster rate to preempt potential competition from other parties.

In addition to the above motivations, the litigation risk of trading before the disclosure of Schedule 13Ds is likely to be low. Although Rule 10b5-1 states that trading while in possession of material non-public information is illegal, it is practically difficult for the SEC to prove (1) that the insider actually possesses nonpublic information, and (2) that such information is material. Therefore, the SEC generally limits its enforcement of insider trading in cases based on foreknowledge of earnings announcements and acquisitions. In my sample, in particular, proving (1) is especially difficult, given that the filing of Schedule 13Ds is not a corporate event, but is rather investor-based, resulting in insiders' lack of precise information about the disclosure's timing or specific content. My research did not materialize any cases of SEC enforcement actions or class-action lawsuits against insiders' trades based on foreknowledge of Schedule 13Ds.

Given the incentives and low litigation risks discussed above, I predict that executives will trade before the filing of Schedule 13Ds to take advantage of the positive market movements at disclosure. Specifically, I hypothesize that:

H1: Insiders increase (reduce) purchases (sells) over the days leading up to the disclosure of Schedule 13Ds.

5. Data and Sample Construction

I compile data from several sources. I collect all Schedule 13Ds filed between 2002 and 2016 from the SEC's Edgar database. I obtain data of insider trades from the Thomson Reuters Insider database, stock returns from the Center for Research in Security Prices (CRSP), and financial items from Compustat Quarterly database. To classify Schedule 13D filers as either hedge funds or non-hedge funds, I use the list of hedge fund activists provided by Professor Wei Jiang,[20] the Hedge Fund Research (HFR) database, 13F filings from Edgar, and a general Internet search.

5.1 The sample of Schedule 13Ds

I use a top-down approach to construct my sample. I start with 30,909 Schedule 13Ds filed between 2002 and 2016 for which I can identify trigger dates based on an automatic search script. I begin in 2002 in the post-Reg FD period to avoid any selective disclosures of nonpublic material information from target firms' managers to Schedule 13D filers.

I perform the following steps. First, I match target firms to Compustat using the Central Index Key (CIK), to CRSP using the CRSP-Compustat link file, and to the Thomson Reuters Insider database using the CUSIP identifier. Second, I retain only target firms whose CRSP exchange codes are 1, 2, 3 or 4 (as listed in the major exchanges) and whose share codes are 10, 11, or 12 (ordinary common shares). Third, I exclude Schedule 13Ds related to management buyouts. Specifically, I compile a list of managers' names for each Schedule 13D from the Thomson Reuter Insider database, assuming that a filing is related to a management buyout when a manager's name appears on the form. Fourth, I exclude Schedule 13Ds related to repurchases, i.e., filings with the same filer and target firm. Fifth, I retain only the Schedule 13Ds filed with the SEC within 1 to 13 calendar days of the trigger date.[21] Sixth, I restrict to original Schedule 13Ds and eliminate Schedule 13D/A filings that are mistakenly classified as original Schedule 13Ds (e.g., amendments to previously submitted filings or disposition of stocks).[22] Seventh, I require target firms' market data to be available 30 days before and after the filing date. Eighth, I keep only one filing if multiple filings are submitted for the same event. These procedures and limitations lead to an initial sample of 3,347 Schedule 13Ds.

Next, I manually review each of the 3,347 Schedule 13Ds to retain only those wherein filers acquired the shares through open-market transactions. After completing

[20] I am grateful to Professor Wei Jiang for providing the list of hedge fund activists.

[21] Although Rule 13d-1(a) requires Schedule 13D filers to submit the form within 10 days after the trigger date, I find that Schedule 13D filers often interpret the 10-day period in terms of business rather than calendar days, with the trigger date clustered during the (t-13, t-9) period prior to the filing date.

[22] Rule 13d-1(a) requires an investor or group of investors deciding to act as a legal group who attain a 5% or greater share in any class of a company's securities and possess an interest in influencing the management of the company to file a Schedule 13D. Filing is required within 10 days of crossing the 5% threshold. If the Schedule 13D filer's previously established position changes by more than 1% of shares outstanding, either positive or negative, they are required to file amendments to the original Schedule 13D filing.

this process, I further eliminate Schedule 13Ds wherein (1) filers made purchases through previously announced agreements, such as stock purchase agreements, note purchase agreements, merger agreements, contribution agreements, or voting agreements; (2) filers made purchases through public offerings; and (3) filers obtained stocks through private placements, gifts, or transfers. My final sample consists of 2,087 Schedule 13Ds that were filed by 928 unique filers for 1,860 unique target firms.

Appendix 2 presents an example of a Schedule 13D. For each Schedule 13D, I extract the following data: Schedule 13D filer's CIK, target firm's CIK, filing date, trigger date, and Schedule 13D filer's beneficial ownership on the filing date. In addition, I manually review item 4 of Schedule 13D's "Purpose of Transaction" section and classify the filer's stated objectives into the following three categories. The first category includes filings in which the Schedule 13D filer believes that the target firm is undervalued and acquires the shares solely for investment purposes. The second category includes those in which the filer indicates that they plan to or have already communicated with management. The last category includes filings that state specific activism goals, either regarding target firms' capital structure, business strategy, corporate governance, or along other lines.

Moreover, Item 5(c) of Schedule 13D requires the filer to report the date, price, and quantity of all trades in the target firm executed during the 60 calendar days that precede the filing date. I hand-collect the stock trading information for 1,823 Schedule 13Ds. Transaction data are often reported at a daily frequency, but if they are reported at a higher-than-daily frequency, I aggregate them to the daily level.

Table 1 summarizes the final sample of Schedule 13Ds. Panel A of Table 1 reports the distribution of Schedule 13Ds by year. The number of Schedule 13Ds varies by year, peaking in 2000, 2007, and 2008. I compare the industry composition of target firms with that of Compustat firm-years over the same sample period in Table 1, panel B. The two data sets are generally similar, except that target firms have a higher representation of firms operating in the sectors of information technology and consumer discretionary, and a lower representation of firms operating in the energy and materials sector. Panel C of Table 1 reports the distribution by filer type. A total of 65.9% of Schedule 13Ds were filed by hedge funds, a considerable number of which can be traced to the following specific funds: Gabelli funds, Gamco Investors, Discover funds, and Farallon Capital. Panel D of Table 1 lists the distribution by filers' stated purpose of transaction. A total of 36.6% of Schedule 13Ds are for investment purposes only; 41.4% indicate an intention to communicate with managers; and 22.1% are activism-based, delineating specific goals targeting either target firms' capital structure, business strategy, corporate governance, or other aspects.

5.2 Data on insider trading

Section 16a of the Securities and Exchange Act of 1934 requires insiders to report their transactions on Form 4 within two business days. I draw primary data on insider trades from the Thomson Reuters Insider database. I define insiders as officers and

directors with the ROLECODE of “AV”, “CB”, “CEO”, “CFO”, “CI”, “CO”, “CT”, “D”, “DO”, “EVP”, “H”, “O”, “OB”, “OD”, “OP”, “OT”, “OS”, “OX”, “P”, “S”, “SVP”, “VC”, or “VP.” I restrict to open-market purchases and sales by insiders (TRANCODE equal to “P” or “S”). I aggregate purchases and sales by insiders on the same trading day to obtain a daily total. Insider purchases and sales are measured as the daily fraction of shares outstanding sold by insiders presented in basis points (SHARES from the Thomson Reuter Insider database divided by SHROUT from CRSP scaled as basis points of shares outstanding). These insider trading measures can have extreme outliers, and therefore I winsorize non-zero values at the 1% level.

I adopt the methodology of Lie (2005) and Dechow et al. (2016) to control for the normal level of insider purchases and sales. I take five observations for the same firm with a date randomly chosen from between six and three months prior to the Schedule 13D filing date and between three and six months afterward. I refer to these five observations per firm as “random control period observations.” Abnormal pre-disclosure insider purchases (sales) are thus calculated as the average daily insider purchases (sales) during the window surrounding the filing of Schedule 13Ds minus the average daily insider purchases (sales) during the corresponding window for the random control period observations.

6. Empirical Analyses

6.1 Descriptive statistics

6.1.1 Descriptive statistics of Schedule 13D filers' trading strategies

I begin by demonstrating how Schedule 13D filers acquire shares during the 60 calendar days preceding the filing date. This timeline is essential to identify whether managers trade on foreknowledge of Schedule 13D filers' purchases for the following analyses. I hand-collect Schedule 13D filers' stock trading information reported in Item 5(c) of Schedule 13Ds. Summary statistics for Schedule 13D filers' trading strategies over the 60-day window are reported in panel A of Table 2. The average (median) stock ownership on the filing date is 6.6% (5.8%). The average (median) initial stock ownership at day -60 prior to the filing date is 2.7% (3.0%). It follows that the average (median) filer purchases 3.9% (3.2%) of outstanding shares over the 60-day window. The average (median) filer trades for 16 days (14 days), accounting for 37.7% (33.3%) of trading days over the 60-day window. On days that Schedule 13D filers trade, the average (median) filer accounts for 63% (22.1%) of the daily volume. I define a trade as large if it accounts for more than 20% of the daily volume. Based on this definition, the average (median) filer makes 6.7 (5) large trades over the 60-day window.

Using Schedule 13D filers' trading data and their stock ownership on the filing date, I back out their holdings at a daily frequency in the pre-disclosure period. Figure 3 plots the average percentage of outstanding shares owned by Schedule 13D filers from 20 days prior to the trigger date to the filing date. It is shown that the average Schedule 13D filer gradually increases holdings from 3.3% to 4.9% between day -20 to -1 prior to the trigger date. On the trigger date, the filer makes aggressive purchases of close to 1% and crosses the 5% threshold. After crossing the 5% threshold, the filer continues to purchase after the trigger date and holds 6.6% of shares outstanding by the filing date.

To summarize, the evidence above highlights that (1) Schedule 13D filers have accumulated a considerable percentage of shares at day -20 prior to the trigger date; (2) Schedule 13D filers do not trade everyday but rather every three days; (3) when they trade, Schedule 13D filers trade a relatively large fraction of the daily volume; and (4) Schedule 13D filers trade aggressively on the trigger date.

6.1.2 Descriptive statistics of target firms' characteristics

Panel B of Table 2 provides descriptive statistics of target firms. I measure daily pre-disclosure insider purchases (sales) as the daily percentage of shares outstanding purchased (sold) by insiders reported in basis points during the pre-disclosure period from 20 days prior to the trigger date to one day prior to the filing date. The mean daily pre-disclosure insider purchases (sales) are 0.076 (0.167) basis points of shares outstanding. The level of insider sales is higher than insider purchases, since insiders receive stock compensation. I use dummy variables to indicate whether a firm's insiders purchase or sell shares during the pre-disclosure period and find that 11.6% of firms have insider purchases and 16.4% of firms have insider sales. I also report the summary statistics of

target firms' financial characteristics for the quarter or as of the quarter end immediately before the filing of Schedule 13Ds. The median firm has a market value of $185 million, suggesting that target firms tend to be small stocks. This is consistent with the fact that large firms are less likely to be targeted because the filer would have to invest a significant amount of capital to cross the 5% threshold. Moreover, target firms have a median book-to-market ratio of 0.63, trailing 12-month earnings-to-price ratios of 0.02, ROA of 0.008, and a sales growth rate of 2.4 percent.

6.2 Abnormal insider trading prior to disclosure of Schedule 13Ds

6.2.1 Univariate analyses

My first objective is to investigate whether abnormal insider trading occurs prior to the disclosure of Schedule 13Ds. Table 3 presents the average daily insider trading in target firms over nonoverlapping windows that span the period from 30 days prior to the trigger date to 20 days after the filing date. I compare that with corresponding windows of random control period observations. Panel A of Table 3 reports the results of insider purchases. It reveals that insiders purchase at a normal level until six days prior to the trigger date, after which they increase their level of purchases. Specifically, there are significant abnormal purchases of 0.035 basis points of shares outstanding per day during the period between five to one day prior to the trigger date and 0.056 basis points of shares outstanding per day from the trigger date to one day prior to the filing date. These two numbers correspond to an abnormal increase in insider purchases of 63.9% and 145.7% relative to the random control periods, respectively. Furthermore, insiders continue to engage in abnormal purchases after the filing date until five days afterwards.

Panel B of Table 3 reports the results of insider sales. It reveals that insiders significantly decrease the level of sales starting from 20 days until six days prior to the trigger date. Specifically, insiders sell 33% less shares than normal levels during the period between 20 to 11 days prior to the trigger date, and they sell 35.6% less shares than normal levels during the period between 10 to six days prior to the trigger date. Insiders generally sell at normal levels in other windows surrounding the disclosure of Schedule 13Ds.

Figure 3 visually confirms the existence of abnormal insider trading prior to Schedule 13D disclosure. Panel A plots the cumulative daily insider purchases relative to the mean for the random control period observations from 20 days prior to the trigger date to 20 days after the filing date. It shows that insider purchases begin to diverge from the control period observations a few days before the trigger date, with 32% greater cumulative insider purchases in the window up to the filing date. Panel B plots the cumulative daily insider sales over the same period and demonstrates that the cumulative insider sales are 20% less than normal levels in the window up to the filing date.

Overall, the univariate analyses suggest that insiders sell less from 20 to six days prior to the trigger date and begin to purchase more starting from five days prior to the trigger date up until the filing date. This may indicate that insiders stop selling when they possess vague information and subsequently increase purchases when they obtain more

detail regarding Schedule 13D filers as the filing date draws closer. Insiders' increased level of purchases just five days before the trigger date suggests that managers possess precise information about Schedule 13D filers' purchases and that they time their trades accordingly.

6.2.2 Regression analyses

Next, I examine whether the univariate results hold after controlling for other determinants of insider trading. I compare the level of insider trading in the pre-disclosure period with that in the random control periods using the following pooled event-day regression model:

$$\begin{aligned} Daily\ Insider\ Trading = \alpha &+ \beta_1 Schedule 13D \\ &+ \beta_2 Size \\ &+ \beta_3 BTM \\ &+ \beta_4 Illiquidity \\ &+ \beta_5 Volatility \\ &+ \beta_6 Daily\ Return \\ &+ \beta_7 Past\ Return \\ &+ \beta_8 DailyVol \\ &+ \beta_9 PastVol \\ &+ \beta_{10} PastPurchases \\ &+ \beta_{11} PastSales \\ &+ \varepsilon \quad (1). \end{aligned}$$

The dependent variable $Daily\ Insider\ Trading$ is either the daily insider purchases, daily insider sales, or daily insider net purchases. The main variable of interest, $Schedule\ 13D$, is an indicator variable that is equal to one if the daily observation falls into Schedule 13D's pre-disclosure period, or equal to zero if the daily observation falls into the corresponding window of random control observations. I examine two pre-disclosure periods: a large window that covers the period of (TD-20, FD-1) and a small window that covers the days between the trigger date and filing date. I control for the following aspects of target firms: size, book-to-market, illiquidity, and volatility. To control for contemporaneous news, I include the daily abnormal returns, past 30-day returns, daily abnormal volume, and past 30-day abnormal volume. I also control for the level of insider purchases and sales in the past 30 days.

Table 5 reports the regression results for equation (1). Consistent with the univariate results, the significant positive coefficients on *Schedule 13D* in columns 3 and 6 indicate that insiders engage in more net purchases in the pre-disclosure period than in the random control periods. Specifically, the significant coefficient of 0.049 in column 3 suggests that the daily insider net purchases average 0.049 basis points higher during the pre-disclosure period of (TD-20, FD-1) than during the control periods. The significant coefficient of 0.080 in column 6 indicates that daily insider net purchases average 0.080 basis points higher during the period between the trigger date and filing date than during the control periods. In addition, the significant coefficients on *Schedule 13D* in columns

2 and 4 suggest that the abnormal net purchases are driven by both abnormally higher purchases and abnormally lower sales in the pre-disclosure period.

To summarize, the findings in Table 3, Table 4, and Figure 3 provide evidence consistent with my hypothesis that insiders possess private information of Schedule 13D filers' trades and that they strategically purchase more and sell less to exploit it prior to the public disclosure of Schedule 13Ds.

6.2.3 Addressing alternative explanations

Other explanations for my results exist aside from my hypothesis regarding insiders' trading based on private knowledge. One such alternative is that Schedule 13D filers and insiders simply trade on the private information that target firms are undervalued. Yet another is that the results could stem from "reverse causality," i.e., that Schedule 13D filers base their trades on insiders' abnormal trades. These two arguments seem reasonable given that prior literature has documented that insiders trade on private information of firms' future performances (e.g., Piotroski & Roulstone, 2005) and because insiders' trades are widely scrutinized by investors.

Both of the aforementioned explanations would predict that insiders would trade before Schedule 13D filers do. To illustrate, regarding the first explanation, if both parties simply trade on private information about target firms' undervaluation, insiders would be better positioned ahead of time and thus would likely trade before Schedule 13D filers. If, per the second proposed rationale, Schedule 13D filers base their trades on insiders' abnormal trades, they should have observed abnormal insider trading before they conduct their trades. However, I find that insiders begin to purchase more at trading day -5 prior to the trigger date. In comparison, the average Schedule 13D filer has already accumulated 4.3% of shares outstanding at trading day -5 prior to the trigger date. The cumulative evidence is inconsistent with the two alternative explanations' prediction that insiders would trade before Schedule 13D filers.

To further refute these explanations, I focus on the days that Schedule 13D filers make large trades and compare insider trading over the five-day window before the large trades and five-day window on and after the large trades. If insiders trade on private information of Schedule 13D filers' purchases, I would expect to observe a higher level of insider (net) purchases in the post-large-trade window than the pre-large-trade window. In contrast, if both parties trade based on private information of target firms' undervaluation, I would expect a similar level of insider trading in the post- and pre-window given that the firm's fundamental is unlikely to change over this short span. Lastly, if Schedule 13D filers base their trades on insiders' abnormal trades, I would expect a higher level of insider (net) purchases in the pre-large trade window. The different predictions of the three explanations reveal the driving force behind my results. Following the above discussion, I run the pooled event-day regression model of the following form:

$$Daily\ Insider\ Trading = \alpha + \beta_1 Post\ Large\ Trade$$

$$+\beta_2 Daily\ Return$$
$$+\beta_3 Past\ Return$$
$$+\beta_4 DailyVol$$
$$+\beta_5 PastVol$$
$$+\varepsilon \quad (2).$$

The dependent variable $Daily\ Insider\ Trading$ is either the daily insider purchases, daily insider sales, or daily insider net purchases. The main variable of interest, $Post\ Large\ Trade$, is an indicator variable that is equal to one if the daily observation falls into the post-large-trade window, or equal to zero if the daily observation falls into the pre-large-trade window. I define a trade as large if the Schedule 13D filer's trades account for more than 20% of trading volume on a given day.[23] To control for contemporaneous news, I include the daily abnormal returns, past 30-day returns, daily abnormal volume, and past 30-day abnormal volume.

Table 5 reports the regression results for equation (2). Consistent with the hypothesis that insiders trade on private information of Schedule 13D filers' purchases, I document that insider (net) purchases are significantly higher during the post-window than the pre-window. The results summatively refute the alternative explanations regarding abnormal insider trading prior to Schedule 13D disclosure.

6.2.4 Cross-sectional tests

The 2015 Activist Investor Survey by NIRI has indicated that managers learn of trading activities in their firm's stock through two major private channels: direct contact with investors and the use of stock-surveillance firms. I've observed the first channel in my sample: 15% of Schedule 13D filers voluntarily disclose their communication with management in the "Purpose of Transaction" section. Due to the covert function of the second channel, I cannot observe the use of stock-surveillance firms directly. Yet, I want to offer a glimpse of their indirect use in this subsection.

My private conversations with stock-surveillance firms suggest that it is easier to detect large trades than small ones. Motivated by this finding, I predict that the more concentrated trades that a Schedule 13D filer makes when accumulating the 5% of shares, the more likely that their activity would be discovered by stock-surveillance firms, and thus, insiders would be more inclined to engage in abnormal trading. Following the discussion, I run the cross-sectional regression model of the following form on the sample of 2,087 Schedule 13Ds:

$$Avg.Daily\ Insider\ Trading = \alpha + \beta_1 Total\ Stock\ Ownership$$
$$+\beta_2 13D\ Filer\ Avg.Daily\ Trade\ Size$$
$$+\beta_3 Size$$
$$+\beta_4 BTM$$
$$+\beta_5 Illiquidity$$

[23] My results are robust to alternative definitions of large trades using the cut-off values of 10% or 30 percent.

$$
\begin{aligned}
&+\beta_6 Volatility \\
&+\beta_7 Contemporaneous\ Return \\
&+\beta_8 Momentum \\
&+\beta_9 Abnormal\ Volume \\
&+\beta_{10} Past\ Abnormal\ Volume \\
&+\beta_{11} Exp.Insider\ Purchases \\
&+\beta_{12} Exp.Insider\ Sales \\
&+\varepsilon \quad (3).
\end{aligned}
$$

The dependent variable $Avg.Daily\ Insider\ Trading$ is either the average value of daily insider purchases, daily insider sales, or daily insider net purchases during the pre-disclosure period of (TD-20, FD-1). The main variable of interest, $13D\ Filer\ Avg.Daily\ Trade\ Size$ is the average percentage of shares outstanding that Schedule 13D filers trade on days with trades in the 60-day period prior to the disclosure. I control for Schedule 13D filers' total stock ownership stock ownership during the 60-day period, and target firms' size, book-to-market, illiquidity, and volatility. To control for contemporaneous news, I include the contemporaneous stock returns, momentum, abnormal volume, and past abnormal volume. I also control for the level of expected insider purchases and sales.

Table 6 reports the regression results for equation (3). The significant positive coefficient on the $13D\ Filer\ Avg.Daily\ Trade\ Size$ in column 3 indicates that the larger trades that Schedule 13D filers make over the 60-day period, the higher level of abnormal insider net purchases. The results are consistent with the prediction that the larger trade size that a Schedule 13D filer make when accumulating the 5% of shares, the more likely it is that their activity would be discovered by stock-surveillance firms, and thus insiders would be more inclined to engage in abnormal trading. The finding is also visually confirmed in Figure 5.

I also investigate whether the pre-disclosure insider trading varies by target firms' size. I would expect more strategic insider trading activities for smaller firms because smaller firms generally have higher ex ante information rents available to insiders (i.e., more information asymmetry that can be exploited by insiders). Figure 6 confirms my expectation and shows that the a much higher magnitude of strategic insider trading in smaller firms.

6.3 Do insiders profit from abnormal insider trading?

Next, I investigate whether insiders benefit from abnormal trading in the pre-disclosure period. First, I estimate insiders' profits for the 242 target firms with pre-disclosure insider purchases. Insiders make an average purchase of $190,931 during the pre-disclosure period for these target firms. I estimate insiders' trading profits using the following method:

$$Trading\ Profits = q'(p_{post} - p_{purchase}) \quad (4).$$

where q is the vector of purchases over the pre-disclosure period, p_{post} is the post-announcement price at day 5 after the filing date, and $p_{purchase}$ is the vector of purchase prices. The measure assumes that insiders buy and hold the stock until five days after the filing date. Using this method, I estimate that insiders earn average profits of $49,400 per Schedule 13D for the 242 target firms with pre-disclosure insider purchases, indicative of a return of 25.8% in about 30 trading days (over 300% annually).

Insiders earn profits by either direct or indirect means: by engaging in purchases or ceasing to sell, respectively. Next, I rely on the summary statistic of net purchases and estimate the trading profits for 757 target firms with positive abnormal insider net purchases over the pre-disclosure period. On average, insiders make abnormal net purchases of $1,204,059 in the pre-disclosure period. Since I cannot observe transaction prices for discontinued selling activity, I use an alternative method which likely estimates the lower boundary of trading profits by assuming insiders only hold stocks from day 0 to 5:

$$\begin{aligned} &Trading\ Profits \\ &\quad = Raw\ Announcement\ Returns \\ &\quad * \$Abnormal\ insider\ net\ purchases \end{aligned} \quad (5).$$

where $Raw\ Announcement\ Returns$ is the buy-and-hold stock return accumulated from the filing date to five days afterwards, and $\$Abnormal\ insider\ net\ purchases$ is the dollar amount of abnormal insider net purchases in the pre-disclosure period. Based on this method, I estimate that on average, insiders earn profits of $43,193 per Schedule 13D event for the 757 target firms with pre-disclosure insider abnormal net purchases, indicative of a lower bound return of 3.6% in about 30 trading days.

6.4 Does insider trading facilitate the price discovery of target firms?

After establishing that insiders opportunistically trade in the pre-disclosure period and that they earn significant profits from such activity, I examine whether the stock market recognizes that insiders trade on private information of upcoming Schedule 13Ds. Specifically, I investigate whether insider trading facilitates the price discovery of target firms prior to Schedule 13Ds' public disclosure. Given that insiders are required to report their trades within two business days, if the stock market recognizes that these trades are related to insiders' private information of upcoming Schedule 13Ds, I would expect a higher price-runup (pre-disclosure return) and lower return upon disclosure for Schedule 13Ds with pre-disclosure insider trading.

This test is related to the ongoing debate regarding the effect of insider trading on stock price efficiency. Opponents of insider trading argue that such activity generates exploitative managerial practices and is unfair to uninformed investors. Its proponents claim that insider trading improves stock price accuracy and mitigates the incentive for multiple individuals to collect the same information. This supposition is supported by several empirical studies (e.g., Meulbroek, 1992; Piotroski & Roulstone, 2004).

To carry out this test, I use a cross-sectional regression model of the following form:

$$\begin{aligned} Y = \alpha + \ & \beta_1 I(Abnormal\ insider\ net\ purchases > 0) \\ & + \beta_2 Size \\ & + \beta_3 BTM \\ & + \beta_4 ETP \\ & + \beta_5 Momentum \\ & + \varepsilon \quad (6). \end{aligned}$$

Dependent variable Y is either the pre-disclosure returns cumulated from 20 days prior to the trigger date to one day prior to the filing date, or the disclosure returns cumulated from the filing date to five days afterwards. The main variable of interest, $I(Abnormal\ insider\ net\ purchases > 0)$, is an indicator variable that is equal to one if the insider's abnormal net purchases are positive over the pre-disclosure period (TD-20, FD-1). I control for risk factors of size, book-to-market ratio, earnings-to-price ratio, and momentum.

Table 8 reports the results for equation (6). The insignificant coefficient on $I(Abnormal\ insider\ net\ purchases > 0)$ indicates that the stock market does not recognize that insiders trade on private information of upcoming Schedule 13Ds.

6.5 Are pre-disclosure insider traders informed of future stock and operating performances?

Next, I explore whether the pre-disclosure abnormal insider trading signals target firms' future stock and operating performances. Ex-ante, insiders are more likely to trade in the pre-disclosure period if they expect higher profits. Since the positive return upon Schedule 13D disclosure reflects filers' revelation of target firms' undervaluation, insiders will be more likely to trade if their companies are truly undervalued and they expect a higher return after the disclosure of such information. Although investors do not seem to differentiate between Schedule 13Ds with pre-disclosure insider trading and those without (as shown in section 4.4), the stock market should integrate such information over time. In this situation, I would expect target firms with abnormal pre-disclosure insider trading to produce higher stock returns and to perform at a higher level in the future than those without such activity.

First, I test whether target firms with pre-disclosure insider trading display better future stock performance. I use a cross-sectional regression model of the following form:

$$\begin{aligned} Post\_disclosure\ Returns = \alpha + \ & \beta_1 I(Abnormal\ insider\ net\ purchases > 0) \\ & + \beta_2 Size \\ & + \beta_3 BTM \\ & + \beta_4 ETP \\ & + \beta_5 Momentum \\ & + \varepsilon \quad (7). \end{aligned}$$

The dependent variable $Post\ disclosure\ Returns$ is the buy-and-hold market-adjusted stock returns cumulated from day 6 to 120 after the filing date. The main variable of interest, $I(Abnormal\ insider\ net\ purchases > 0)$ is an indicator variable that is equal to one if insiders' abnormal net purchases are bigger than zero over the pre-disclosure period (TD-20, FD-1). I control for risk factors of size, book-to-market ratio, earnings-to-price ratio, and momentum. Table 9 reports the results for equation (7). Column 2 shows that over the period from day 6 to 120 following the filing date, target firms with abnormal pre-disclosure insider trading earn 8.3% higher returns than those without such activity. This is also visually confirmed in Figure 7.

Next, I investigate whether target firms with pre-disclosure insider trading perform better in the future. I use a cross-sectional regression model of the following form:

$$\begin{aligned} Outcome = \alpha + \ & \beta_1 I(Abnormal\ insider\ net\ purchases > 0) \\ & + \beta_2 Size \\ & + \beta_3 BTM \\ & + \beta_4 ROA \\ & + \varepsilon \quad (8). \end{aligned}$$

I consider the following operating outcome variables for the quarter that Schedule 13Ds are filed and the following three quarters: year-over-year growth in total assets, year-over-year change in revenue, year-over-year change in ROA, and year-over-year change in debt. The main variable of interest, $I(Abnormal\ insider\ net\ purchases > 0)$, is an indicator variable that is equal to one if insiders' abnormal net purchases are higher than zero over the pre-disclosure period (TD-20, FD-1). I control for firm characteristics of size, book-to-market ratio, ROA, industry, and year fixed effects. Table 10 reports the results for equation (8). For ease of exposition, I only report the coefficients on the variable of interest. Consistent with my prediction, the results reveal that target firms with abnormal pre-disclosure insider trading have higher growth in total assets, revenue, ROA, and leverage over the year following the disclosure of Schedule 13Ds.

6.6 Are pre-disclosure insider traders informed of future likelihood of being acquired?

Finally, I explore whether the pre-disclosure abnormal insider trading signals about target firms' likelihood of being acquired in the next five years following the filing of Schedule 13Ds. Table 10 highlights that target firms with abnormal pre-disclosure insider net purchases are 4.3% less likely to be acquired than target firms without abnormal insider trading. This likely reflects that insiders trade on better performance of their companies on a standalone basis.

7. Conclusion

In this paper, I examine whether managers obtain and exploit private information of trading activity in their firm's stocks. Specifically, I document that insider purchases (sales) are significantly higher (lower) than normal levels immediately before the disclosure of Schedule 13Ds. The level of pre-disclosure insider (net) purchases is higher when activist investors make larger trades, as these are more likely to be detected by insiders. I find that the stock market fails to recognize that insiders trade on private information of activist investors' purchases, given that pre-disclosure insider trading does not facilitate price discovery of target firms. Furthermore, I discern that pre-disclosure insider trading can forecast target firms' future stock and operating performances. Overall, my results suggest that managers gain substantial private information about their investor base and that one observable, but not exclusive use of this acquisition is through insider trading.

My findings contribute to the ongoing debate of whether insider trading is detrimental or beneficial to the stock market and raise questions about the use and misuse of insider information. Opponents of insider trading argue that insider trading decreases market liquidity, produces abusive managerial practices, and is unfair to uninformed investors. Its proponents (e.g., Carlton and Fischel, 1983; Manne, 1996a, b) claim that insider trading fosters efficient capital markets and promotes quick price discovery, mitigating the incentive for multiple individuals to collect the same data. On one hand, I show that managerial profit derived from trades on private information of investors' holdings is unfair to uninformed market participants. On the other hand, I find that these insider trades convey information about future stock and operating performances, and that as such, investors should regard them as credible signals to forecast underlying firms' performances.

I have several suggestions for future research. First, in this study I examine insider trading prior to the disclosure of activist investors' block holdings on Schedule 13Ds. It would be instructive to investigate whether insiders trade ahead of other ownership disclosures, such as Form 13F or mutual fund disclosures. Second, I focus on only one observable use of managers' private information about investor holdings, i.e., insider trading. This private information may impact other managerial behavior as well as firms' operational policies. For example, managers may initiate repurchases, poison pills, or boost stock performances when learning of undesirable investors' accumulation of their firm's stocks. Future studies should focus on alternative observable uses to discern other impacts and outcomes of managers' possession of private information.

References

Agarwal, V., W. E. I. Jiang, Y. Tang, and B. Yang. 2013. Uncovering Hedge Fund Skill from the Portfolio Holdings They Hide. *Journal of Finance* 68 (2): 739–783.

Agarwal, V., K. A. Mullally, Y. Tang, and B. Yang. 2015. Mandatory Portfolio Disclosure, Stock Liquidity, and Mutual Fund Performance. *Journal of Finance* 70 (6): 2733–2776.

Agrawal, A., and T. Nasser. 2012. Insider trading in takeover targets. *Journal of Corporate Finance* 18 (3): 598–625.

Boyson, N. M., N. Gantchev, and A. Shivdasani. 2017. Activism mergers. *Journal of Financial Economics* 126 (1): 54–73.

Brav, A., W. E. I. Jiang, F. Partnoy, and R. Thomas. 2008. Hedge Fund Activism, Corporate Governance, and Firm Performance. *Journal of Finance* 63 (4): 1729–1775.

Brav, A., W. Jiang, and H. Kim. 2015. The Real Effects of Hedge Fund Activism: Productivity, Asset Allocation, and Labor Outcomes. *Review of Financial Studies* 28 (10): 2723–2769.

Brown, S. J., and C. Schwarz. 2013. The Impact of Mandatory Hedge Fund Portfolio Disclosure. *SSRN Electronic Journal* (May 2011).

Bushee, B. J., J. Gerakos, and L. F. Lee. 2018. Corporate jets and private meetings with investors. *Journal of Accounting and Economics* 65 (2–3): 358–379.

Bushee, B. J., M. J. Jung, and G. S. Miller. 2017. Do Investors Benefit from Selective Access to Management? *Journal of Financial Reporting* 2 (1): 31–61.

Bushee, B. J., and G. S. Miller. 2012. Investor relations, firm visibility, and investor following. *Accounting Review* 87 (3): 867–897.

Carlton, D.W. and Fischel, D.R., 1983. The regulation.of insider trading, *Stanford Law Review,* 35, 857-895.

Chapman, K. L., G. S. Miller, and H. D. White. 2018. Investor Relations and Information Assimilation. *The Accounting Review* 90 (4): accr-52200.

Cheng, Q., and K. Lo. 2006. Insider Trading and Voluntary Disclosures. *Journal of Accounting Research* 44 (5): 815–848.

Clifford, C. P. 2008. Value creation or destruction? Hedge funds as shareholder activists. *Journal of Corporate Finance* 14 (4): 323–336.

Cohen, L., C. Malloy, and L. Pomorski. 2012. Decoding Inside Information. *The Journal of Finance* 67 (3): 1009–1043.

Collin-Dufresne, P., and V. Fos. 2015. Do Prices Reveal the Presence of Informed Trading? *Journal of Finance* 70 (4): 1555–1582.

Dechow, P. M., A. Lawrence, and J. P. Ryans. 2016. SEC Comment Letters and Insider Sales. *The Accounting Review* 91 (2): 401–439.

Green, T. C., R. Jame, S. Markov, and M. Subasi. 2014. Broker-hosted investor conferences. *Journal of Accounting and Economics* 58 (1): 142–166.

Greenwood, R., and M. Schor. 2009. Investor activism and takeovers. *Journal of Financial Economics* 92 (3): 362–375.

Holden, C. W., and A. Subrahmanyam. 1992. Long-Lived Private Information and Imperfect Competition. *The Journal of Finance* 47 (1): 247.

Huddart, S., B. Ke, and C. Shi. 2007. Jeopardy, non-public information, and insider trading around SEC 10-K and 10-Q filings. *Journal of Accounting and Economics* 43 (1): 3–36.

Kahle, K. M. 2000. Insider trading and the long-run performance of new security issues. *Journal of Corporate Finance* 6 (1): 25–53.

Karpoff, J. M., and D. Lee. 1991. Insider Trading Before New Issue Announcements. *Financial Management* 20 (1): 18–26.

Ke, B., S. Huddart, and K. Petroni. 2003. What insiders know about future earnings and how they use it: Evidence from insider trades. *Journal of Accounting and Economics* 35 (3): 315–346.

Kirk, M. P., and J. D. Vincent. 2014. Professional investor relations within the firm. *Accounting Review* 89 (4): 1421–1452.

Lakonishok, J., and I. Lee. 2001. Are Insider Trades Informative? *Review of Financial Studies* 14 (1): 79–111.

Lee, D. S., W. H. . Mikkelson, and M. M. Partch. 1992. Managers ' Trading Around Stock Repurchases. *The Journal of Finance* 47 (5): 1947–1961.

Lie, E. 2005. On the Timing of CEO Stock Option Awards. *Management Science* 51 (5): 802–812.

Maggio, M. Di, F. Franzoni, A. Kermani, and C. Sommavilla. 2019. The relevance of broker networks for information diffusion in the stock market. *Journal of Financial Economics* 134 (2): 419–446.

Massa, M., W. Qian, W. Xu, and H. Zhang. 2015. Competition of the informed: Does the presence of short sellers affect insider selling? *Journal of Financial Economics* 118 (2): 268–288.

Manne, H.G., 1966a. Insider trading and the stock market. Free Press.

Manne, H.G., 1966b. Defense of insider trading. *Harvard Business Review*, 44(6), pp.113-122.

Meulbroek, L. 1992. An Empirical Analysis of Illegal Insider Trading. *Journal of*

Finance 47 (5): 1661–1699.

National Investor Relations Institute (NIRI). 2007. *2007 CFO/NIRI Survey.* Vienna, VA: NIRI.

National Investor Relations Institute (NIRI). 2015. *NIRI Activist Investor Survey-2015.* Vienna, VA: NIRI.

Noe, C. F. 1999. Voluntary disclosures and insider transactions. *Journal of Accounting and Economics* 27 (3): 305–326.

Piotroski, J. D., and D. T. Roulstone. 2004. The Influence of Analysts, Institutional Investors, and Insiders on the Incorporation of Market, Industry, and Firm-Specific Information into Stock Prices. *The Accounting Review* 79 (4): 1119–1151.

———. 2005. Do insider trades reflect both contrarian beliefs and superior knowledge about future cash flow realizations? *Journal of Accounting and Economics* 39 (1): 55–81.

Rozeff, M. S., and M. A. Zaman. 1998. Overreaction and Insider Trading: Evidence from Growth and Value Portfolios. *The Journal of Finance* 53 (2): 701–716.

Seyhun, H. N. 1992. Why Does Aggregate Insider Trading Predict Future Stock Returns? *The Quarterly Journal of Economics* 107 (4): 1303–1331.

Seyhun, H. N., and M. Bradley. 1997. Corporate Bankruptcy and Insider Trading. *The Journal of Business* 70 (2): 189–216.

Solomon, D., and E. Soltes. 2015. What Are We Meeting For? The Consequences of Private Meetings with Investors. *The Journal of Law and Economics* 58 (2): 325–355.

Wong, F. 2017. Wolves at the Door: A Closer Look at Hedge-Fund Activism. *Columbia Business School Research Paper No. 16-11*.

Appendix 1
Survey of Investor Relation Officers

Panel A: Do you monitor changes in your investor base?

	number	percentage
Yes	271	94%
No	16	6%

Source: 2007 CFO/NIRI Survey

Panel B: If yes, how do you monitor your investor base?

	number	percentage
Track SEC filings	178	64%
Subscribe to surveillance service	158	57%
Review data provided by exchange	114	41%
Other	39	14%

Source: 2007 CFO/NIRI Survey

Panel C: If you subscribe to a surveillance service, how accurate do you consider the information reported?

	number	percentage
Very accurate	51	29%
Somewhat accurate	114	65%
Not accurate	10	6%

Source: 2007 CFO/NIRI Survey

Panel D: How do IR professionals most often learn about an activist investor's involvement?

	2007	2015
SEC filing	26%	20%
Stock surveillance firm	17%	20%
Direct contact by investor	49%	49%
News media	1%	2%
Hear from their investment banker	1%	1%
Other	6%	8%

Source: 2015 NIRI Activist Investor Survey

Appendix 2
Example of a Schedule 13D Filed by Frontline

On March 20, 2008, Frontline Ltd. ("FRO", $3.4B of market cap.), an international seaborne transporter of crude oil, and its affiliates filed a Schedule 13D and announced their stake of 5.2% in Overseas Shipholding Group, Inc. ("OSG", $2.1B of market cap.), a New York-based bulk shipping company. Click here for the Schedule 13D file.

Frontline stated that they had acquired the shares for investment purposes. See below for the original statement detailed in Item 4 of their Schedule 13D:

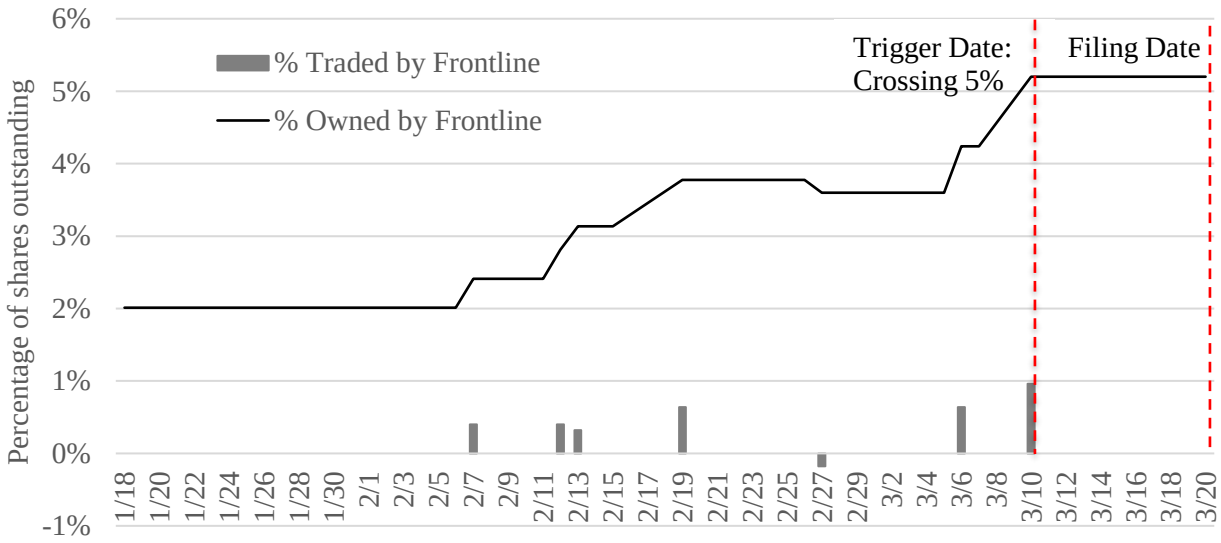
> *"The Reporting Persons have acquired their shares of the Issuer for investment. The Reporting Persons have no plans or proposals as of the date of the filing. The Reporting Persons reserve the right to be in contact with members of the Issuer's management, the members of the Issuer's Board of Directors, other significant shareholders and others regarding alternatives that the Issuer could employ to increase shareholder value. The Reporting Persons further reserve the right to act in concert with any other shareholders of the Issuer, or other persons, for a common purpose should it determine to do so, and/or to recommend courses of action to the Issuer's management, the Issuer's Board of Directors and others."*

In item 5(c), Frontline and its affiliates reported their trades during the past 60 days:

Date of Transaction	*Number of Shares Purchased (Sold)*	*Price*
2/7/2008	*125,000*	*64.78*
2/12/2008	*125,000*	*65.26*
2/13/2008	*100,000*	*66.19*
2/19/2008	*200,000*	*67.71*
2/27/2008	*(55,100)*	*71.34*
3/6/2008	*200,000*	*58.91*
3/10/2008	*200,000*	*58.63*
3/10/2008	*100,000*	*57.29*
3/13/2008	*(1,444,900)*	*64.53*
3/13/2008	*1,444,900*	*64.53*

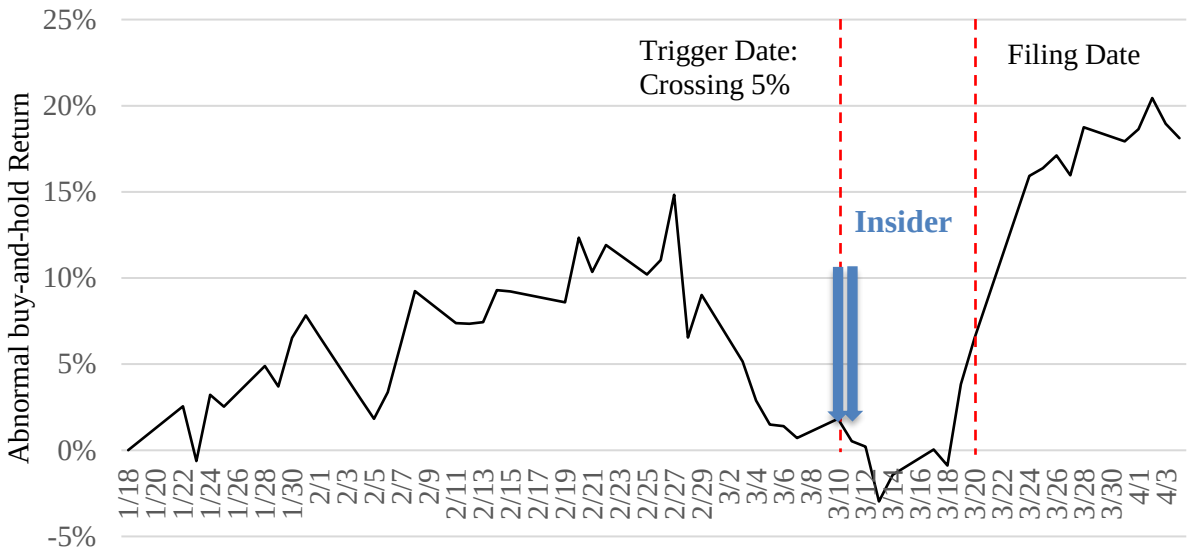
To visualize Frontline and its affiliates' transactions, I plot their trades and holdings as a percentage of OSG's number of shares outstanding at a daily frequency

over the two-month period prior to the filing of Schedule 13D. (This figure should have a figure number like figure A1)



The release of Schedule 13D had a huge impact on OSG's stock price. In the second graph below, I plot OSG's market-adjusted buy-and-hold return around Schedule 13D's release, from two months prior to the filing date to 15 days afterward. As shown, OSG gained a market-adjusted return of 9.4% on the filing date and a total return of 16% over the (-3, +3) window surrounding the filing date. The significant positive returns likely reflected Frontline's revelation of OSG's undervaluation and the market's expectation of possible consolidation between the two companies. Frontline commented on the possibility of consolidation a few days after the filing date. However, it did not carry out the plan and sold its position in July.

Notably, Merkin Solomon, an OSG board member, made significant purchases prior to the Schedule 13D filing. He purchased 1,400 shares for $81,144 on March 10, 2008 (the trigger date) and another 1,200 shares for $68,136 the following day. With a closing price of $68.22 on March 20, 2018, the 2,600 shares were worth $177,372, and Merkin earned $28,092, with a return investment of 18.8% in less than 10 days.


Abnormal buy-and-hold Return
25%
20%
15%
10%
5%
0%
-5%
Trigger Date:
Crossing 5%
Filing Date
Insider
1/18
1/20
1/22
1/24
1/26
1/28
1/30
2/1
2/3
2/5
2/7
2/9
2/11
2/13
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3/18
3/20
3/22
3/24
3/26
3/28
3/30
4/1
4/3

Appendix 3
Variable Definition

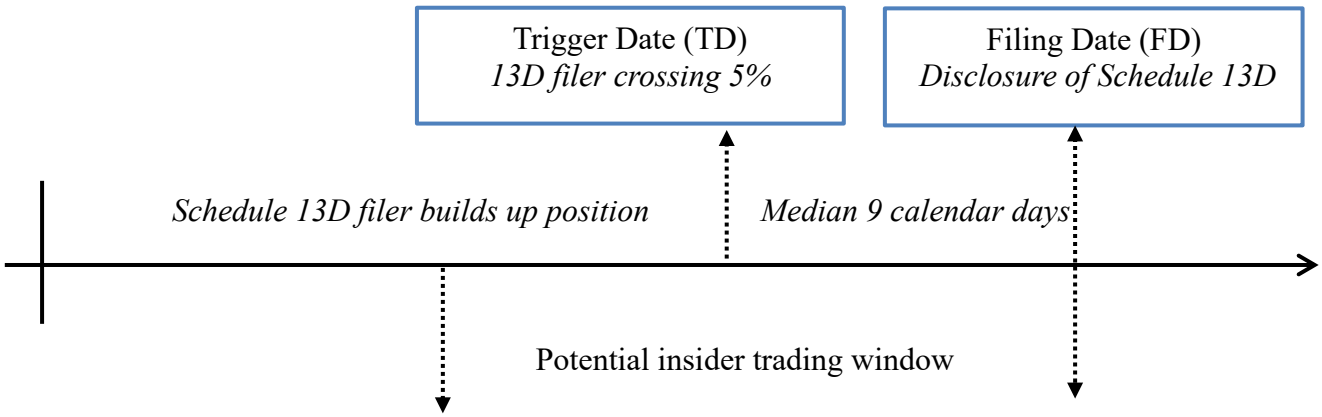
Variable	Definition
ΔA_q	Target firm's year-over-year growth in total assets for quarter *q* following the filing of Schedule 13D.
$\Delta Debt_q$	Target firm's year-over-year change in debt (scaled by last year's total assets for the same quarter) for quarter *q* following the filing of Schedule 13D.
ΔREV_q	Target firm's year-over-year change in revenue (scaled by last year's total assets for the same quarter) for quarter *q* following the filing of Schedule 13D.
ΔROA_q	Target firm's year-over-year change in ROA for quarter *q* following the filing of Schedule 13D.
13D filer % days with informed trades	The ratio of *number of trading days* to the total number of trading days during the 60 calendar days preceding the filing date.
13D filer % volume on trading days	The average percentage of daily volume that corresponds to the trades executed by the Schedule 13D filer across all trading days with informed trades.
13D filer change in stock ownership	The increase in stock ownership as a percentage of shares outstanding. Schedule 13D filers are required to disclose their trades in the target firm executed during the 60 calendar days preceding the filing date.
13D filer change in stock ownership per trading day	The average change in stock ownership per trading day as a percentage of the number of shares outstanding on days with informed trades.
13D filer initial stock ownership	I calculate the implied initial stock ownership as the difference between stock ownership on the filing date minus *change in stock ownership*.
13D filer number of large trades	The number of trading days during which the Schedule 13D filer executed more than 20% of the daily volume.
13D filer number of trading days	The number of days that Schedule 13D filers trade during the 60-day period before the filing date.
13D filer stock ownership on filing date	Total beneficial ownership of the Schedule 13D filer on the filing date.
Abnormal volume	The average *daily volume* during the pre-disclosure period (TD-20, FD-1). This is used in the cross-sectional test.

Avg. daily insider net purchases, pre-disclosure	The average value of *Daily insider net purchases* during the pre-disclosure period (TD-20, FD-1) prior to the filing of Schedule 13D.
Avg. daily insider purchases, pre-disclosure	The average value of *Daily insider purchases* during the pre-disclosure period (TD-20, FD-1) prior to the filing of Schedule 13D.
Avg. daily insider sales, pre-disclosure	The average value of *Daily insider sales* during the pre-disclosure period (TD-20, FD-1) prior to the filing of Schedule 13D.
BTM	Target firm's book-to-market ratio as of trading day -21 prior to the trigger date (TD).
Daily insider net purchases	Calculated as the difference between *Daily insider purchases* and *Daily insider sales*.
Daily insider purchases	Daily shares purchased by insiders (SHARES where TRANCODE is "P" in Thomson Reuter), divided by the number of shares outstanding scaled in basis points. Insiders are defined as officers and directors with ROLECODE of "AV", "CB", "CEO", "CFO", "CI", "CO", "CT", "D", "DO", "EVP", "H", "O", "OB", "OD", "OP", "OT", "OS", "OX", "P", "S", "SVP", "VC", or "VP." Non-zero values are winsorized at the 1% level.
Daily insider sales	Daily shares sold by insiders (SHARES where TRANCODE is "S" in Thomson Reuter), divided by the number of shares outstanding scaled in basis points. Non-zero values are winsorized at the 1% level.
Daily returns	The target firm's market-adjusted stock return for a given day *t.*
Daily volume	The abnormal trading volume excluding insider trades of target firm on day *t.* Normal trading volume is measured as the average trading volume in the (-120, -61) period prior to day *t*.
Disclosure returns	Target firm's buy-and-hold market-adjusted stock returns cumulated from the filing date to 5 days afterwards.
ETP	Target firm's trailing 12M earnings to price ratio as of the most recent fiscal quarter-end prior to the filing date. Trailing 12M earnings are computed using the item *ibq* from Compustat.
I (abnormal insider net purchases>0)	Equal to one if insiders' abnormal net purchases are positive over the pre-disclosure period (TD-20, FD-1) prior to the filing of Schedule 13D, and zero otherwise. I measure

	insider net purchases as insider purchases minus insider sales. Abnormal insider net purchases are defined as the difference between the insider net purchases transacted in the pre-disclosure period and the average insider net purchases transacted during the random control observations.
Illiquidity	Target firm's Amihud illiquidity measure, defined as the average value of $1000\sqrt{\lvert Return\rvert / DollarTradingVolume}$ using daily data over the period of trading day -50 to -21 prior to the trigger date.
Market Cap.	Target firm's market capitalization ($MM) as of trading day -21 prior to the trigger date (TD).
Momentum	Target firm's buy-and-hold market-adjusted stock returns cumulated from trading day -50 to -21 prior to the trigger date.
Normal insider purchases	The average value of *Daily insider purchases* during the random control periods.
Normal insider sales	The average value of *Daily insider sales* during the random control periods.
Past abnormal volume	The average *daily volume* during day -50 to -21 prior to the trigger date. This is used in the cross-sectional test.
Past insider purchases	The average insider purchases of target firm during the 30-day period immediately before day *t.*
Past insider sales	The average insider sales of target firm during the 30-day period immediately before day *t.*
Past returns	The market-adjusted buy-and-hold stock returns of target firm during the 30-day period immediately before day *t.*
Past volume	The average *daily volume* during the 30-day period immediately before day *t.*
Post large trade	Equal to one if day *t* falls into the window of day 0 to 5 after the Schedule 13D filer executed more than 20% of the daily volume, and zero otherwise.
Post-disclosure returns	Target firm's buy-and-hold market-adjusted stock returns cumulated from trading day 6 to 120 past the filing date.
Pre-disclosure insider purchases, dummy	Equal to one if there are insider purchases in the pre-disclosure period (TD-20, FD-1).
Pre-disclosure insider sales, dummy	Equal to one if there are insider sales in the pre-disclosure period (TD-20, FD-1).

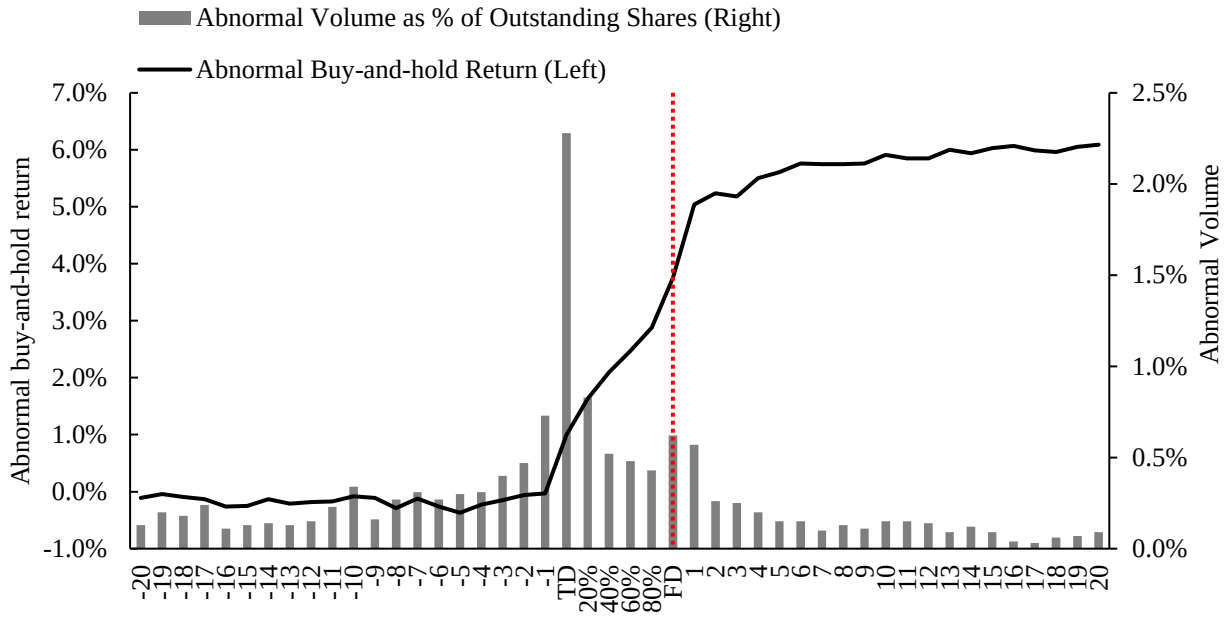
Pre-disclosure returns	Target firm's buy-and-hold market-adjusted stock returns cumulated from 20 trading days prior to the trigger date to one day prior to the filing date.
Revenue growth	Target firm's year-over-year growth in revenue (*revtq* from Compustat) for the most-recent fiscal quarter prior to the filing date.
ROA	Target firm's trailing 12M earnings (*ibq* from Compustat) divided by total assets (*atq* from Compustat) as of the most recent fiscal quarter end prior to the filing date.
Schedule 13D	Equal to one if day *t* falls into the pre-disclosure period of (TD-20, FD-1).
Size	The logarithm of *Market Cap*.
Volatility	The standard deviation of target firm's daily stock returns over the period of trading day -50 to -21 prior to the trigger date.

Figure 1
Timeline of a Schedule 13D



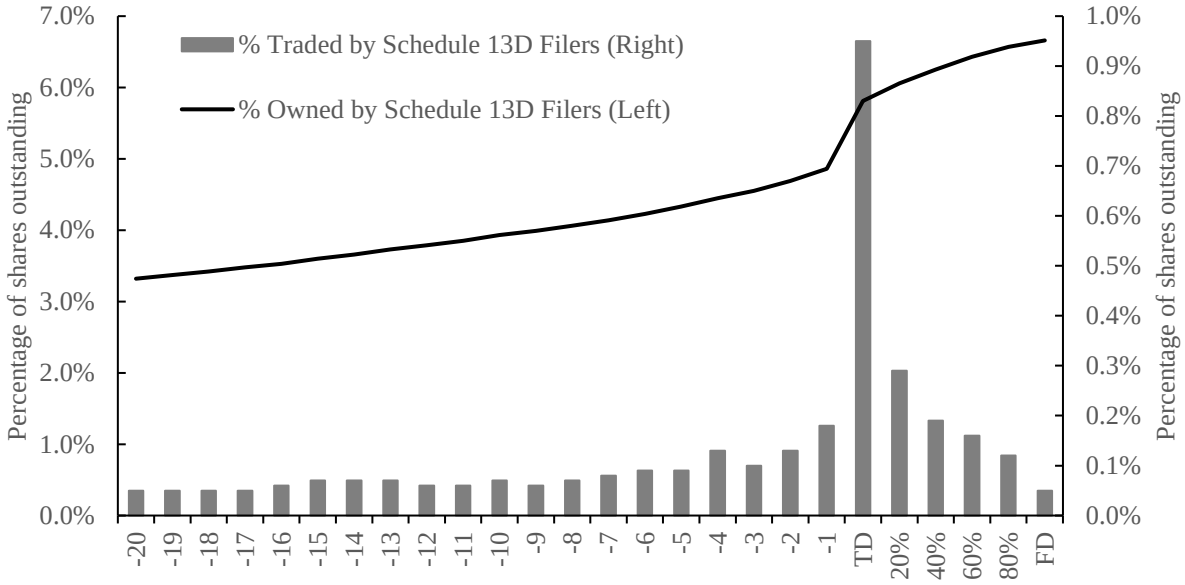
This figure presents the timeline of a typical Schedule 13D. I term the date on which the Schedule13D filer crosses the 5% threshold as Trigger Date (TD). I term the date on which the Schedule 13D is filed with the SEC as Filing Date (FD).

Figure 2
Buy-and-hold Abnormal Return and Volume Around Schedule 13D Filing



This figure presents the buy-and-hold abnormal return and abnormal volume for target firms surrounding the filing of Schedule 13Ds. The black solid line (left axis) plots the average buy-and-hold return, in excess of the buy-and-hold return of the value-weight market, from 20 trading days prior to the trigger date to 20 trading days after the filing date. The grey bars (right axis) plot the abnormal volume during the same time window compared to the average volume during the preceding (FD-120, FD-60) window, divided by the number of shares outstanding. Since the time from trigger date to filing date differs across Schedule 13Ds, I normalize the time interval between trigger date and filing date to a relative window from 0% to 100 percent. For example, 50% refers to trading day 5 after the trigger date if the Schedule 13D is filed 10 trading days after the trigger date, but refers to trading day 3 after the trigger date if the Schedule 13D is filed six trading days after the trigger date.

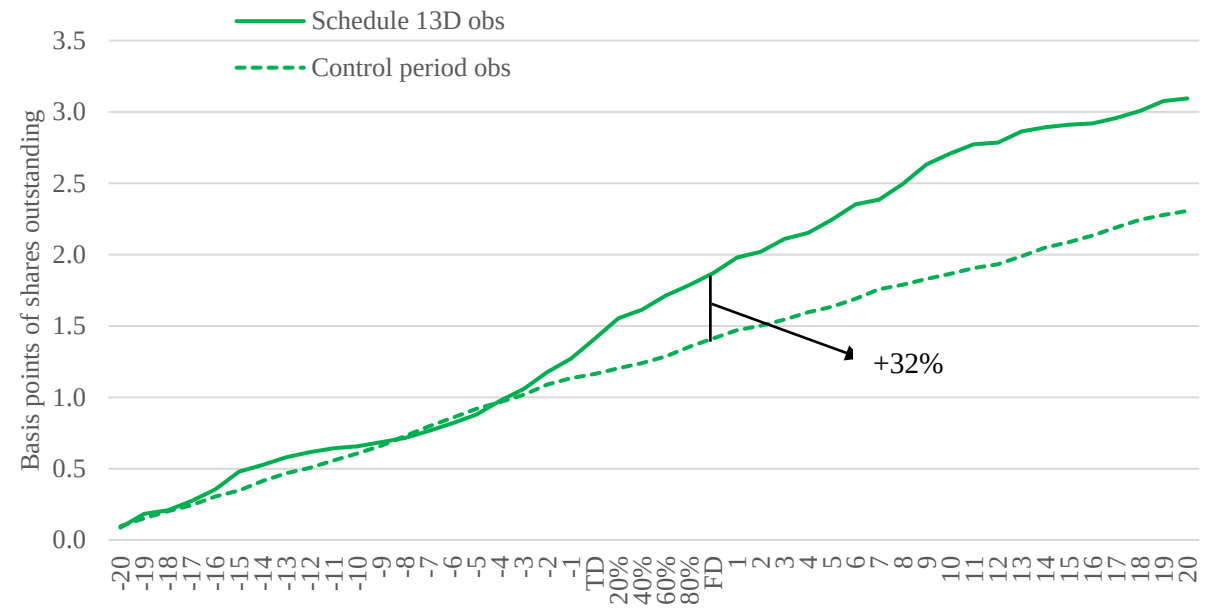
Figure 3
Trading Strategy of Schedule 13D Filers



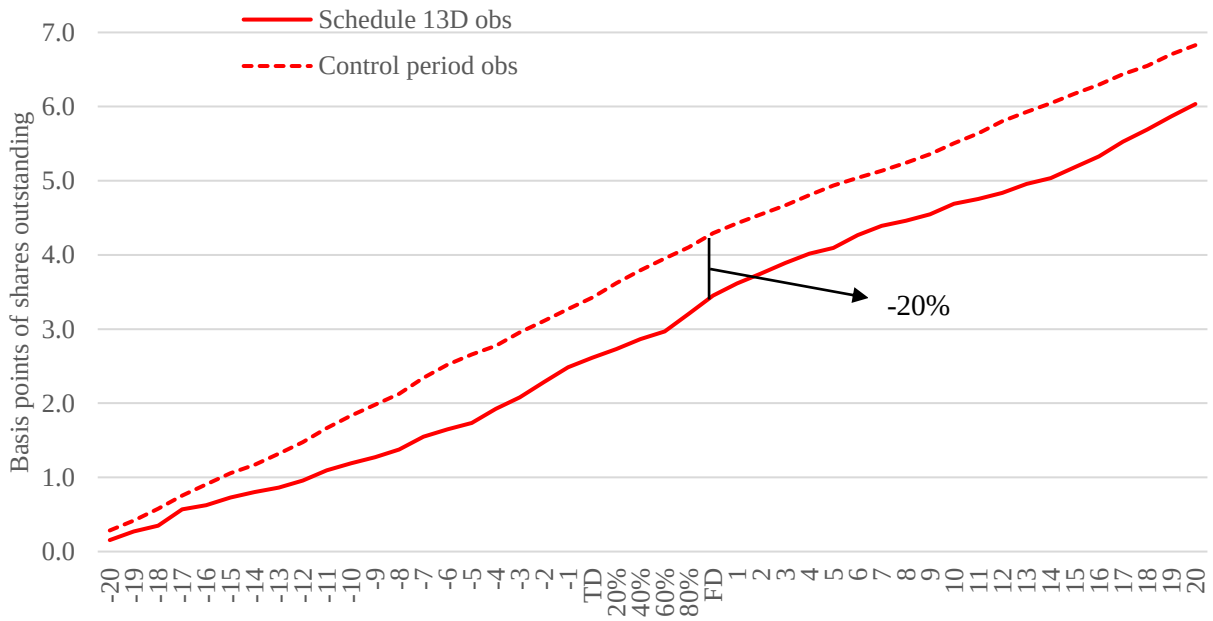
The figure above presents the trading strategy of Schedule 13D filers prior to the filing date. The black solid line (left axis) plots the average value of percentage of outstanding shares owned by Schedule 13D filers from 20 trading days prior to the trigger date to the filing date. The grey bars (right axis) plot the average value of percentage of outstanding shares traded by Schedule 13D filers over the same window. Since the time from trigger date to filing date differs across Schedule 13Ds, I normalize the time interval between trigger date and filing date to a relative window from 0% to 100 percent. I hand-collect filers' daily stock transactions reported in Item 5(c) and stock ownership on the filing date from Schedule 13Ds, available from the EDGAR system, and I back out Schedule 13D filers' daily holdings based on the hand-collected data.

Figure 4
Cumulative Daily Insider Trading Surrounding the Filing of Schedule 13Ds

Panel A: Cumulative Insider Purchases



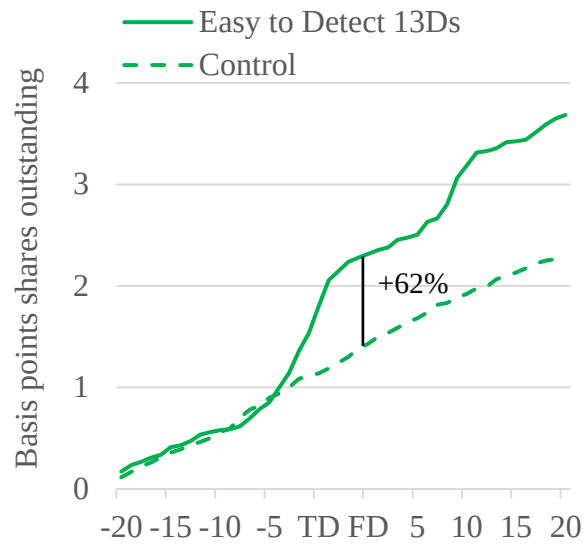
Panel B: Cumulative Insider Sales

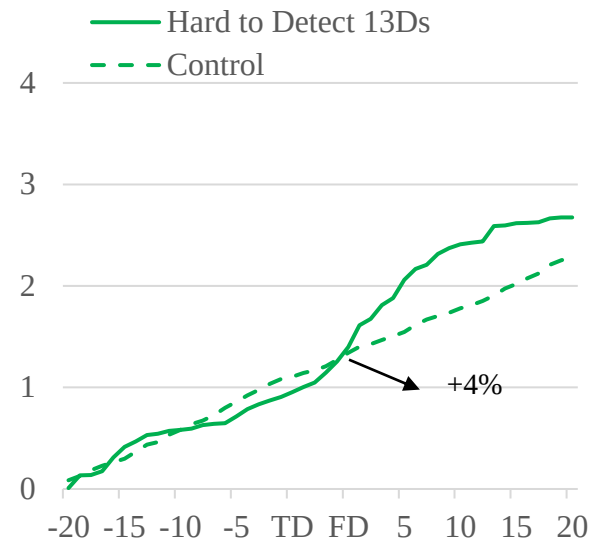


This figure illustrates the cumulative difference in daily insider trading between days surrounding the filing of Schedule 13Ds and random control period observations for target firms. Control period observations are composed of five observations for the same firm with event dates selected randomly from the available trading days between three to six months before and after the filing date of the Schedule 13Ds. Panel A plots the cumulative difference in daily insider purchases from 20 trading days prior to the trigger date to 20 trading days after the filing date. It shows that insider purchases begin to diverge from control period insider purchases five days prior to the filing date, with approximately 32% greater cumulative insider purchases by the filing date. Panel B plots the cumulative difference in daily insider sales over the same window. It shows that insider sales begin to diverge from the control period insider sales 20 days prior to filing date, with approximately 20% less cumulative insider sales by the filing date. Since the time from trigger date to filing date differs across Schedule 13Ds, I normalize the time interval between trigger date and filing date to a relative window from 0% to 100 percent.

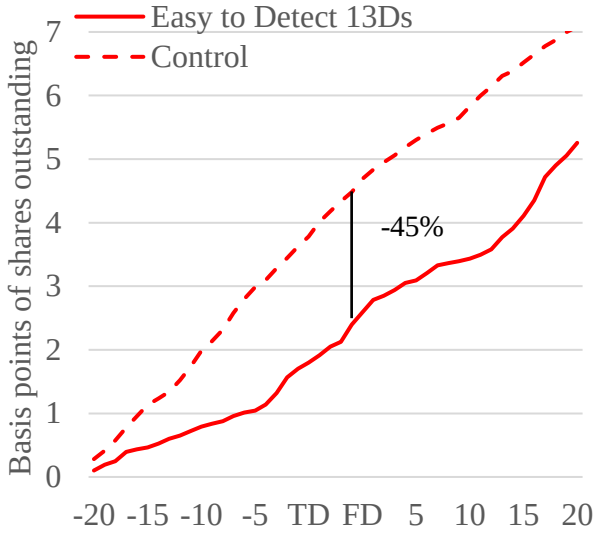
Figure 5
Cumulative Daily Insider Trading Surrounding the Filing of Schedule 13Ds
Variation by Schedule 13D filers' Trade Size

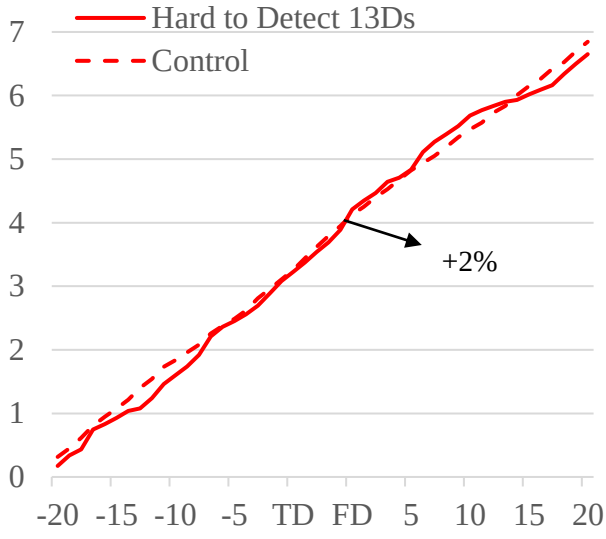
Panel A: Cumulative Insider Purchases





Panel B: Cumulative Insider Sales

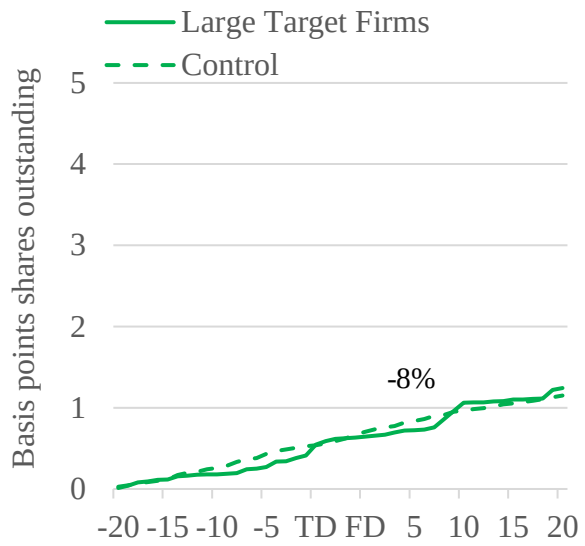


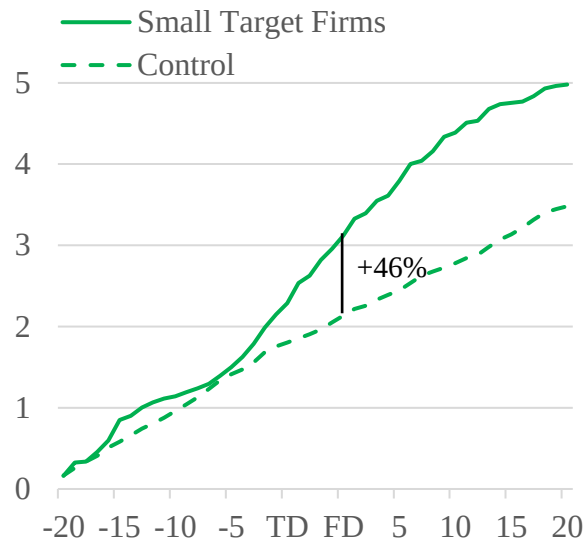


This Figure investigates whether the level of insider trading surrounding the filing of 13Ds vary by Schedule 13D filers' trade size when accumulating the 5% of shares. My conversation with stock-surveillance firms indicates that it is easier for them to detect larger trades and harder to detect smaller trades. Motivated by this, I partition my sample of 13D filings into two groups based on 13D filers' average daily trade size. The easy to detect group is the group that 13D filers make concentrate their trades. The hard to detect group in which 13D filers break into small trades when accumulating the 5% of shares. Panel A plots the cumulative difference in daily insider purchases from 20 trading days prior to the trigger date to 20 trading days after the filing date, separately for the easy to detect and hard to detect subsamples. Panel B plots the cumulative difference in daily insider sales from 20 trading days prior to the trigger date to 20 trading days after the filing date, separately for the easy to detect and hard to detect subsamples. Since the time from trigger date to filing date differs across Schedule 13Ds, I normalize the time interval between trigger date and filing date to a relative window from 0% to 100 percent.

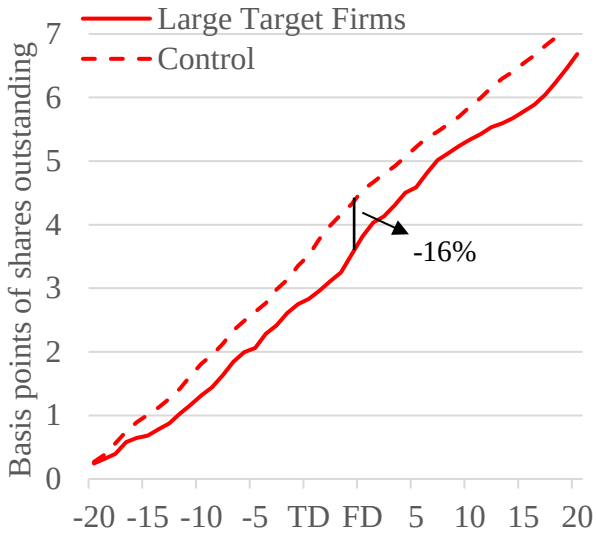
Figure 6
Cumulative Daily Insider Trading Surrounding the Filing of Schedule 13Ds
Variation by Target Firms' Market Cap

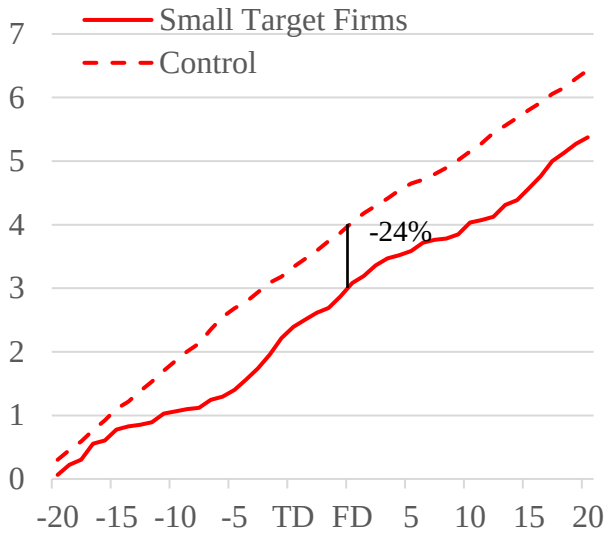
Panel A: Cumulative Insider Purchases





Panel B: Cumulative Insider Sales

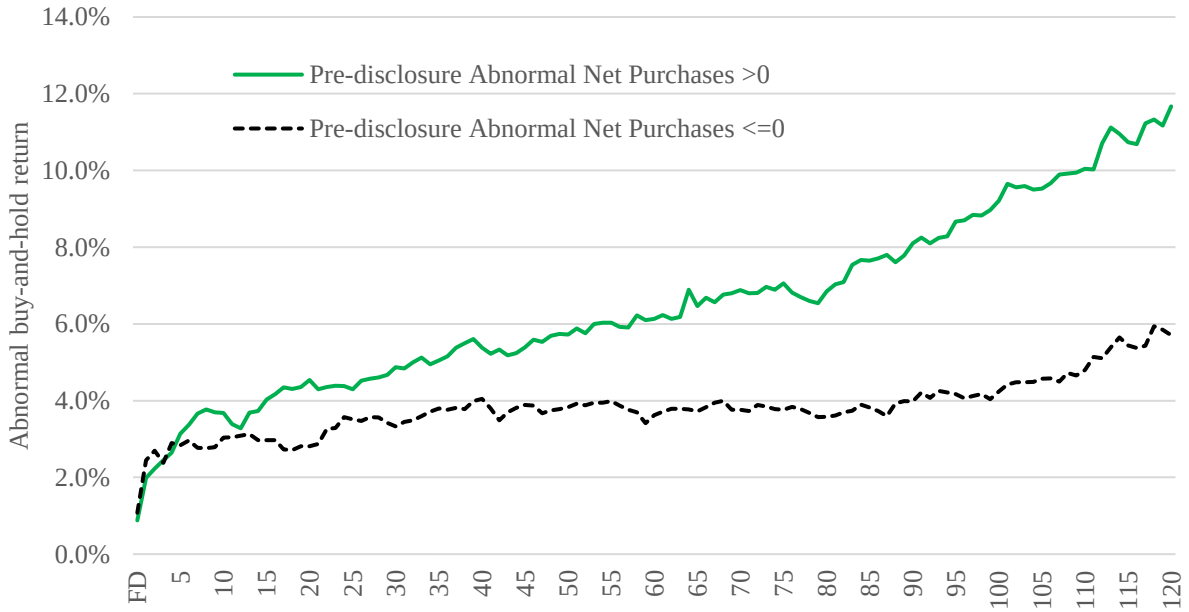




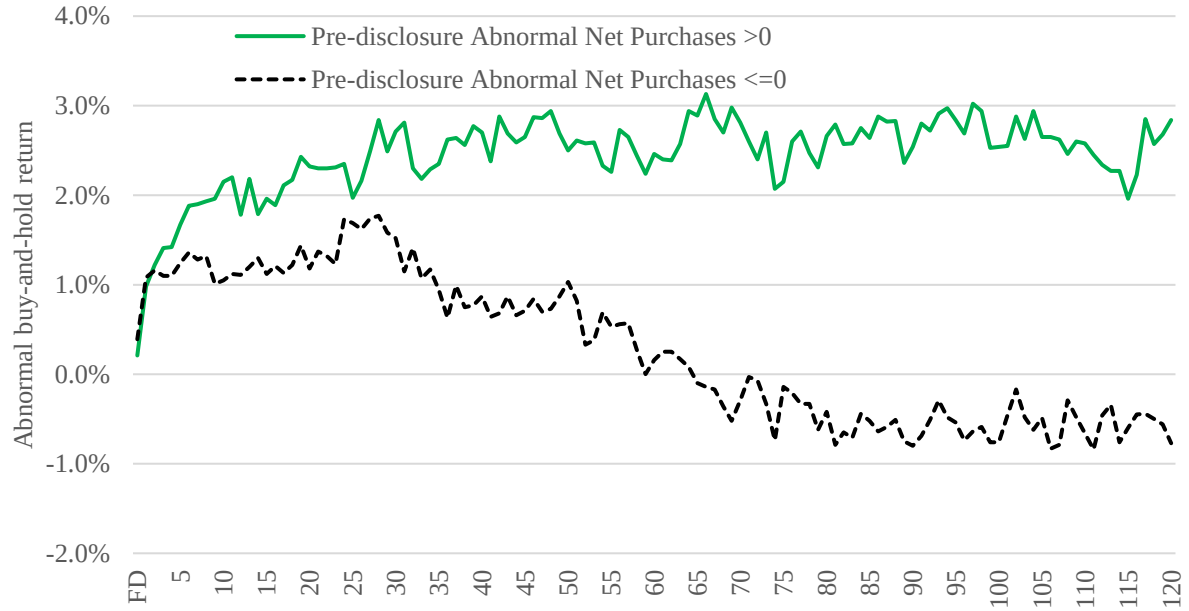
This Figure investigates whether the level of insider trading surrounding the filing of 13Ds vary by target firms' size. I partition my sample of 13D filings into two groups based on target firms' market capitalization. Panel A plots the cumulative difference in daily insider purchases from 20 trading days prior to the trigger date to 20 trading days after the filing date, separately for the large and small target firms' subsamples. Panel B plots the cumulative difference in daily insider sales from 20 trading days prior to the trigger date to 20 trading days after the filing date, separately for the large and small target firms' subsamples. Since the time from trigger date to filing date differs across Schedule 13Ds, I normalize the time interval between trigger date and filing date to a relative window from 0% to 100 percent.

Figure 7
Pre-disclosure Abnormal Insider Trading and Future Stock Returns

Panel A: Average Value of Abnormal Buy-and-hold Return



Panel B: Median Value of Abnormal Buy-and-hold Return



This figure plots the buy-and-hold return for target firms, in excess of the buy-and-hold return of the value-weight market, from the filing date to 120 trading days afterward. I partition target firms into those with and without abnormal insider net purchases during the pre-disclosure period of (TD-20, FD-1). Panel A plots the average value and Panel B plots the median value of the abnormal buy-and-hold returns for target firms. It provides evidence that target firms with pre-disclosure abnormal insider net purchases earn higher future stock returns.

Table 1
Summary of Schedule 13Ds

Panel A: Distribution by Year.

Year	Number of Schedule 13Ds	% of Schedule 13Ds
2002	76	3.6
2003	124	5.9
2004	134	6.4
2005	168	8.1
2006	189	9.0
2007	260	12.5
2008	239	11.5
2009	119	5.7
2010	128	6.1
2011	120	5.8
2012	113	5.4
2013	123	5.9
2014	135	6.5
2015	99	4.7
2016	61	2.9
Total	2,087	100

Panel B: Distribution by Industry.

	Number of Schedule 13Ds	% of Schedule 13Ds	% Compustat
Information Technology	511	24.5	16.2
Consumer Discretionary	448	21.5	12.9
Health Care	288	13.8	12.9
Financials	277	13.3	15.6
Industrials	253	12.1	11.5
Materials	85	4.1	10.3
Energy	81	3.9	8.7
Consumer Staples	68	3.3	4.0
Utilities	30	1.4	3.4
Telecommunication Services	28	1.3	2.0
Real Estate	18	0.9	2.7

Panel C: Distribution by Filer Type.

	No. of Schedule 13Ds	% Schedule 13Ds
Hedge funds	1,376	65.9
Non-hedge funds (e.g., mutual funds, private investors)	711	34.1

Panel D: Distribution by Stated Purpose in Schedule 13D's "Purpose of Transaction."

	No. of Schedule 13Ds	% Schedule 13Ds
Communications with management	863	41.4
Investment purposes only: target firms' undervaluation	763	36.6
Activism with specific proposals (e.g., on capital structure, business strategy, sale of target firm, governance)	461	22.1

This table reports the distribution of the final sample of 2,087 Schedule 13Ds filed with the SEC from 2002 to 2016. Panel A reports the number of Schedule 13Ds by year. Panel B reports the number of Schedule 13Ds by industry, where industry is classified according to the two-digit Global Industry Classification Standard (GICS) codes. Panel C reports the number of Schedule 13Ds by filer type. A hedge fund is defined based on the Hedge Fund Research (HFR) database, the list of hedge fund activism compiled by Professor Wei Jiang, and a general Internet search. Panel D reports the number of Schedule 13Ds by stated purpose of purchase, as identified in Item 4 of Schedule 13D's "Purpose of Transaction" section.

Table 2
Descriptive Statistics

Panel A: Schedule 13D Filers' Trading Strategy.

	Mean	*Std. Dev.*	*p25*	*p50*	*p75*
13D filer stock ownership on filing date	6.6%	1.9%	5.2%	5.8%	7.2%
13D filer initial stock ownership	2.7%	2.3%	0.7%	3.0%	4.5%
13D filer change in stock ownership	3.9%	3.1%	1.4%	3.2%	5.5%
13D filer change in stock ownership per trading day	0.5%	0.9%	0.1%	0.2%	0.4%
13D filer number of trading days	15.82	10.17	7.00	14.00	23.00
13D filer % days with informed trades	37.7%	24.2%	16.7%	33.3%	54.8%
13D filer % volume on trading days	63.0%	229.2 %	11.9%	22.1%	40.4%
13D filer number of large trades (>20% of volume)	6.65	5.99	2.00	5.00	10.00

Panel B: Target Firms' Characteristics.

	Mean	*Std. Dev.*	*p25*	*p50*	*p75*
Avg. daily insider purchases, pre-disclosure	0.076	0.536	0.000	0.000	0.000
Avg. daily insider sales, pre-disclosure	0.167	1.069	0.000	0.000	0.000
Avg. daily insider net purchases, pre-disclosure	-0.091	1.087	0.000	0.000	0.000
Pre-disclosure insider purchases, dummy	11.6%	32.0%	0.0%	0.0%	0.0%
Pre-disclosure insider sales, dummy	16.4%	37.0%	0.0%	0.0%	0.0%
Market Cap. ($ million)	1036.5	3495.4	61.3	185.7	661.8
BTM	0.777	0.781	0.350	0.633	1.010
Trailing 12M Earnings-to-price (ETP)	-0.143	1.518	-0.089	0.020	0.057
ROA	-0.052	0.404	-0.055	0.008	0.045
Revenue Growth	0.349	7.073	-0.094	0.024	0.145
Illiquidity	0.415	0.706	0.048	0.149	0.438
Volatility	0.032	0.022	0.017	0.026	0.039
Pre-disclosure Return	2.1%	19.6%	-8.3%	0.4%	10.7%
Disclosure Return	3.0%	16.0%	-1.8%	1.4%	5.8%
Post-disclosure Return	4.5%	56.0%	-15.7%	-1.4%	13.2%

Panel A reports the descriptive statistics of key variables summarizing Schedule 13D filers' trading strategy. Panel B of this table reports the descriptive statistics of key characteristics of target firms. Variables are defined in Appendix 3.

Table 3
Insider Trading Around Schedule 13D Filing

Panel A: Average Daily Insider Purchases (Scaled by Outstanding Shares in Basis Points).

	Schedule 13D obs.	Random control period obs.	Diff.	% Diff.	t-stat	p-value
day TD-30 to TD-21	0.041	0.049	-0.008	-16.7	-0.901	0.368
day TD-20 to TD-11	0.059	0.051	0.008	16.8	0.836	0.403
day TD-10 to TD-6	0.035	0.059	-0.024	-40.6	-1.514	0.130
day TD-5 to TD-1	0.090	0.055	0.035	63.9	2.058	0.040
day TD to FD-1	0.094	0.038	0.056	145.7	4.445	0.000
day FD to FD+10	0.080	0.045	0.034	75.9	3.483	0.000
day FD+10 to FD+20	0.038	0.043	-0.005	-10.6	-0.488	0.626

Panel B: Average Daily Insider Sales (Scaled by Outstanding Shares in Basis Points).

	Schedule 13D obs.	Random control period obs.	Diff.	% Diff.	t-stat	p-value
day TD-30 to TD-21	0.123	0.147	-0.024	-16.2	-1.353	0.176
day TD-20 to TD-11	0.102	0.152	-0.050	-33.0	-2.775	0.006
day TD-10 to TD-6	0.110	0.171	-0.061	-35.6	-2.213	0.027
day TD-5 to TD-1	0.168	0.151	0.017	11.0	0.651	0.515
day TD to FD-1	0.142	0.150	-0.008	-5.0	-0.319	0.750
day FD to FD+10	0.126	0.125	0.002	1.3	0.110	0.912
day FD+10 to FD+20	0.134	0.132	0.002	1.8	0.144	0.886

This table presents the difference in daily insider trading between days surrounding the filing of Schedule 13Ds and random control period observations for target firms. Control period observations are comprised of five observations from the same firm with event dates selected randomly from the available trading days between three to six months before and after the filing date of the Schedule 13Ds. Panel A presents the difference in daily insider purchases over nonoverlapping windows that cover the period from 20 trading days prior to the trigger date to 20 trading days after the filing date. It shows that, compared with the random control period observations, insiders purchase 64% more stock in the five days prior to the trigger date and purchase 146% more stock during the period between the trigger date and filing date. Panel B presents the difference in daily insider sales. It shows that compared with the random control period observations, target firms' insiders sell approximately 30% less stock from 20 to six trading days prior to the trigger date.

Table 4
Abnormal Insider Trading prior to Schedule 13D Filing

	(1)	(2)	(3)	(4)	(5)	(6)
	TD -20 to FD-1			TD to FD-1		
	Daily insider purchases	Daily insider sales	Daily insider net purchases	Daily insider purchases	Daily insider sales	Daily insider net purchases
Schedule 13D	0.004	-0.045***	0.049***	0.038**	-0.042	0.080***
	(0.50)	(-3.98)	(3.76)	(2.14)	(-1.57)	(2.79)
Size	-0.034	0.118***	-0.152***	-0.014	0.160*	-0.174**
	(-1.44)	(3.29)	(-3.55)	(-0.26)	(2.28)	(-1.97)
BTM	0.004	0.021	-0.017	0.014	0.039	-0.026
	(0.18)	(1.06)	(-0.59)	(0.30)	(1.03)	(-0.43)
Illiquidity	0.011	0.058***	-0.047***	-0.006	0.048*	-0.053*
	(0.82)	(3.83)	(-2.70)	(-0.25)	(2.05)	(-1.65)
Volatility	0.106	-0.566	0.672	1.035	0.432	0.603
	(0.38)	(-1.44)	(1.40)	(1.55)	(0.62)	(0.62)
Daily Returns	0.540***	0.067	0.474***	0.402	-0.093	0.495
	(3.72)	(0.55)	(2.68)	(1.64)	(-0.45)	(1.54)
Past Returns	-0.164***	0.122***	-0.285***	-0.201***	0.124*	-0.324***
	(-7.60)	(4.57)	(-8.43)	(-5.48)	(2.15)	(-4.76)
Daily Volume	0.017***	0.031***	-0.014**	0.006	0.021**	-0.015*
	(3.87)	(6.78)	(-2.27)	(1.23)	(3.33)	(-1.84)
Past Volume	0.009**	0.048***	-0.039***	0.014**	0.040**	-0.026*
	(2.08)	(5.47)	(-4.01)	(2.33)	(2.82)	(-1.72)
Past Insider Purchases	0.069*	-0.029	0.099**	0.213**	-0.035	0.247**
	(1.86)	(-1.64)	(2.39)	(2.25)	(-0.81)	(2.38)
Past Insider Sales	-0.017***	0.121***	-0.138***	-0.003*	0.086*	-0.089**
	(-3.75)	(5.07)	(-5.72)	(-1.87)	(2.30)	(-2.37)
Intercept	0.218	-0.533**	0.751***	0.062	-0.801*	0.863*

	(1.55)	(-2.56)	(2.99)	(0.20)	(-1.95)	(1.67)
Event FE	Y	Y	Y	Y	Y	Y
N	318,644	318,644	318,644	70,967	70,967	70,967
Adjusted R-squared	2.2%	4.1%	3.6%	3.4%	3.5%	3.7%

This table presents results from multivariate regressions that examine whether insiders engage in abnormal trading in the period immediately before the filing of Schedule 13Ds, compared with that of random control period observations. The dependent variable is daily insider purchases, insider sales, or insider net purchases. I examine two pre-disclosure periods: a larger window that covers the days from 20 trading days prior to the trigger date to one day prior to the filing date, and a smaller window that covers days between the trigger date and filing date. The main variable of interest is *Schedule 13D*, an indicator variable that is equal to one if the daily observation falls into the corresponding pre-disclosure period and zero if it falls into the random control periods. The results show that when compared with control periods, insiders purchase more and sell less in the period immediately before the public disclosure of Schedule 13Ds. I report t-statistics in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, using two-tailed tests.

Table 5
Insider Trading Before and After Schedule 13D Filers'

	(1)	(2)	(3)
	Basis points of shares outstanding		
	Daily insider purchases	Daily insider sales	Daily insider net purchases
Post Large Trade	0.097***	-0.005	0.102*
	(2.69)	(-0.13)	(1.84)
Daily Returns	0.571	-0.861*	1.432*
	(0.86)	(-1.90)	(1.78)
Past Returns	-0.312	-0.265	-0.046
	(-1.34)	(-1.00)	(-0.13)
Daily Volume	-0.02	0.058***	-0.078***
	(-1.17)	(2.78)	(-2.90)
Past Volume	0.04	-0.044	0.084
	(0.94)	(-1.34)	(1.56)
Intercept	0.038	0.132***	-0.095**
	(1.62)	(4.42)	(-2.50)
Event FE	Y	Y	Y
N	15,623	15,623	15,623
Adjusted R-squared	10.3%	10.5%	10.7%

This table compares insider trading in the five-trading-day window before and after Schedule 13D filers' large trades. The dependent variable is daily insider purchases, insider sales, or insider net purchases. The main variable of interest is *Post Large Trade*, an indicator variable that is equal to one if the daily observation falls in the post-window, or zero if it falls in the pre-window of a Schedule 13D filer's large trade. I define a Schedule 13D filer's trade as large if the trade accounts for more than 20% of trading volume on that day. To ensure that the pre-window is clean, I restrict to 1,605 large trades that take place at least five trading days away from previous large trades. The results show that insiders increase the level of purchases posterior to Schedule 13D filers' large trades. I report t-statistics in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, using two-tailed tests.

Table 6
Schedule 13D Filers' Trading Strategies and Pre-disclosure Insider Trading

	(1)	(2)	(3)
	Pre-disclosure period (TD-20, FD-1)		
	Average Daily insider purchases	Average Daily insider sales	Average Daily insider net purchases
13D Filer Stock Ownership	-1.006***	0.043	-1.049
	(-3.01)	(0.08)	(-1.57)
13D Filer Daily Trade Size	0.579	-2.053**	2.632**
	(0.77)	(-2.21)	(1.99)
Size	-0.022**	-0.02	-0.003
	(-2.54)	(-1.26)	(-0.17)
BTM	-0.019	-0.012	-0.007
	(-0.86)	(-0.42)	(-0.19)
Illiquidity	0.044	0.049	-0.006
	(1.09)	(1.02)	(-0.11)
Volatility	0.121	-1.267	1.388
	(0.14)	(-0.95)	(0.89)
Pre-disclosure Returns	-0.09	-0.005	-0.085
	(-0.93)	(-0.04)	(-0.57)
Momentum	-0.186**	0.126	-0.312*
	(-2.14)	(0.85)	(-1.82)
Abnormal Volume	0.006	-0.005	0.011*
	(1.30)	(-1.49)	(1.92)
Past Abnormal Volume	-0.001	-0.021	0.02
	(-0.06)	(-1.41)	(1.06)
Normal Insider Purchases	0.210**	-0.073**	0.284***
	(2.44)	(-1.98)	(2.88)
Normal Insider Sales	-0.01	0.071**	-0.081**
	(-0.97)	(2.33)	(-2.48)
Intercept	0.236***	0.298**	-0.062
	(3.03)	(2.24)	(-0.43)
N	1,823	1,823	1,823
Adjusted R-squared	2.8%	0.3%	1.0%

This table exploits cross-sectional variation and examines whether the level of pre-disclosure insider trading is related to Schedule 13D filers' trading strategies. My private conversations with stock-surveillance firms suggest that it is easier (more difficult) for them to detect larger (smaller) trades. Motivated by this, I predict that the larger trade size that a Schedule 13D filer trades when accumulating the 5% of shares, the more likely such activity will be discovered by stock-surveillance firms, and thus insiders are more likely to engage in abnormal trading. The dependent variable is the average daily insider purchases, sales, and net purchases over the pre-disclosure period of (TD-20, FD-1). The main variable of interest is the average daily trade size that Schedule 13D filers trade in the 60-day period prior to the disclosure of Schedule 13Ds. The results are consistent with my prediction. I report t-statistics in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, using two-tailed tests.

Table 7
Does Insider Trading Accelerate the Price Discovery of Target Firms?

	(1)	(2)	(3)	(4)
	Pre-disclosure returns: CAR (TD-20, FD-1)		Disclosure returns: CAR (FD, FD+5)	
I (abnormal Insider net purchases>0)	-0.014	-0.008	0.003	0.003
	(-1.59)	(-0.92)	(0.45)	(0.51)
Size		-0.006**		-0.003
		(-2.21)		(-0.92)
BTM		0.01		0.001
		(1.18)		(0.18)
ETP		-0.002		-0.001
		(-0.27)		(-0.38)
Momentum		0.03		-0.066
		(1.01)		(-1.57)
Intercept	0.026***	0.048**	0.028***	0.041*
	(4.79)	(2.52)	(5.87)	(1.75)
N	2,087	2,087	2,087	2,087
Adjusted R-squared	0.1%	0.5%	0.0%	0.4%

I investigate whether the stock market recognizes that insiders trade on private information of Schedule 13D filers' purchases. Specifically, I examine whether target firms with abnormal pre-disclosure insider net purchases experience more price run-up prior to the disclosure of Schedule 13Ds and lower returns at the disclosure. The dependent variable is pre-disclosure returns or disclosure returns for target firms. The main variable of interest is *I (abnormal Insider net purchases>0)*, an indicator variable that is equal to one if insiders make abnormal net purchases over the pre-disclosure period (TD-20, FD-1), and zero otherwise. The null results suggest that investors do not differentiate between Schedule 13Ds with and without abnormal pre-disclosure insider net purchases. I report t-statistics in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, using two-tailed tests.

Table 8
Pre-Disclosure Insider Trading and Target Firms' Future Stock Performances

	(1)	(2)
	Post-disclosure returns: CAR from day 6 to 120	
I (Abnormal insider net purchases>0)	0.064**	0.083***
	(2.25)	(2.86)
Size		-0.037***
		(-3.31)
BTM		-0.042
		(-0.87)
ETP		-0.043
		(-1.02)
Momentum		-0.123
		(-0.80)
Intercept	0.022*	0.238***
	(1.76)	(2.68)
N	2,087	2,087
Adjusted R-squared	0.3%	2.9%

In this table, I examine whether abnormal pre-disclosure insider trading is indicative of target firms' future stock performances. The dependent variable is post-disclosure returns for target firms. The main variable of interest is *I (abnormal Insider net purchases>0)*, an indicator variable that is equal to one if insiders make abnormal net purchases over the pre-disclosure period (TD-20, FD-1), and zero otherwise. It shows that target firms with abnormal pre-disclosure insider net purchases have better future stock performances of over six percent. I report t-statistics in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, using two-tailed tests.

Table 9
Pre-Disclosure Insider Trading and Target Firms' Future Operating Performances

Panel A: Year-over-year Growth in Total Assets.

	(1)	(2)	(3)	(4)
	Dependent Variable = ΔA_q			
	quarter q	quarter $q+1$	quarter $q+2$	quarter $q+3$
I (Abnormal insider net purchases>0)	0.049***	0.038**	0.056***	0.047***
	(3.28)	(2.58)	(3.47)	(2.82)
Controls	Y	Y	Y	Y
Industry and Year Fixed Effects	Y	Y	Y	Y

Panel B: Year-over-year Change in Revenue.

	(1)	(2)	(3)	(4)
	Dependent Variable = ΔREV_q			
	quarter q	quarter $q+1$	quarter $q+2$	quarter $q+3$
I (Abnormal insider net purchases>0)	0.009***	0.007*	0.007**	0.004
	(2.64)	(1.92)	(2.16)	(1.01)
Controls	Y	Y	Y	Y
Industry and Year Fixed Effects	Y	Y	Y	Y

Panel C: Year-over-year Change in ROA.

	(1)	(2)	(3)	(4)
	Dependent Variable = ΔROA_q			
	quarter q	quarter $q+1$	quarter $q+2$	quarter $q+3$
I (Abnormal insider net purchases>0)	-0.001	0.001	0.005**	0.005
	(-0.42)	(0.27)	(1.99)	(1.51)
Controls	Y	Y	Y	Y
Industry and Year Fixed Effects	Y	Y	Y	Y

Panel D: Year-over-year Change in Debt.

	(1)	(2)	(3)	(4)
	Dependent Variable = $\Delta Debt_q$			
	quarter q	quarter $q+1$	quarter $q+2$	quarter $q+3$
I (Abnormal insider net purchases>0)	0.020***	0.015**	0.016**	0.009
	(2.93)	(2.14)	(2.22)	(1.14)
Controls	Y	Y	Y	Y
Industry and Year Fixed Effects	Y	Y	Y	Y

In this table, I examine whether abnormal pre-disclosure insider net purchases are indicative of target firms' future operating performances in the quarter q when the Schedule 13D is filed and the following three quarters. The dependent variables are year-over-year growth in total assets for Panel A, year-over-year change in revenue (scaled by total assets) for Panel B, year-over-year change in ROA for Panel C, and year-over-year change in debt (scaled by total assets) for Panel D. The main variable of interest is *I (abnormal Insider net purchases>0),* an indicator variable that is equal to one if insiders make abnormal net purchases over the pre-disclosure period (TD-20, FD-1), and zero otherwise. I regress each operational outcome *y* on *I (abnormal Insider net purchases>0),* and control variables including target firms' size, book-to-market ratio, 12M trailing ROA prior to the filing of Schedule 13Ds, industry, and year fixed effects. To streamline interpretation, I only display the coefficients on the main variable of interest. It shows that target firms with abnormal pre-disclosure insider net purchases have higher growth in total assets, revenue, ROA, and leverage in the year following the disclosure of Schedule 13Ds. I report t-statistics in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, using two-tailed tests.

Table 10
Pre-Disclosure Insider Trading and Frequency of Future Takeovers

	Percentage of target firms getting acquired in the next five years
Targets with abnormal insider purchases >0	8.7%
Targets with abnormal insider purchases <=0	13.0%
Dif.	**-4.3%**
P-value	0.0031

In this table, I examine whether abnormal pre-disclosure insider net purchases are indicative of target firms' probability of getting acquired in the next five years following the filing of Schedule 13D. The table compares the probability of getting acquired between target firms that insiders make abnormal net purchases during the pre-disclosure period (TD-20, FD-1), and target firms that insiders do not make abnormal net purchases. It shows that target firms with abnormal pre-disclosure insider net purchases have lower probability of getting acquired following the disclosure of Schedule 13Ds. I report t-statistics in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively, using two-tailed tests.