Run EDGAR Run: 
SEC dissemination in a high-frequency world

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Abstract
We describe the process through which the SEC makes the information in its filings “publicly available,” a critical element of event studies. For a sample of Form 4 (insider trade) filings, we show that the majority of filings are available to paying subscribers of the SEC’s PDS feed before they are posted to the SEC website, and so provide subscribers and their clients with a private advantage. We show that this advantage translates into an economically significant trading advantage, and that prices, volumes, and spreads respond to the news contained in filings beginning around 30 seconds before public posting. Our findings indicate that the SEC dissemination process is not a level playing field and that the meaning of publicly-available information in capital markets is no longer simple or obvious.

Key words: Event Study, Insider trading, High Frequency Trading (HFT); EDGAR; SEC dissemination; SEC filings.

JEL Codes: G14; G28

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1. Introduction

Event studies are ubiquitous in accounting and finance, and rely on the fact that, under semi-strong form market efficiency, security prices quickly reflect public information (Fama, 1970, 1991). To test efficiency, researchers need to know when information becomes publicly available—the more precise this information, the more powerful the test.\(^1\) Because the U.S. Securities and Exchange Commission (SEC) regulates the disclosure of most news about companies, it is important to understand the process through which the SEC disseminates mandated disclosures.

The mechanics of dissemination has become especially critical in a world where trading advantages are measured in fractions of a second. In a widely publicized example, Thomson-Reuters (T-R) sold advance access to the University of Michigan’s Consumer Sentiment Index, a closely watched indicator of consumer spending. Certain clients paid T-R to access the data two seconds before its release to the full set of T-R clients, who in turn received it before its public release (the first set of clients received the feed at 9:54:58 a.m. Eastern time while regular clients received the feed at 9:55:00 a.m.; the news was posted to the university website at 10:00:00 a.m.).\(^2\) While a two second advantage seems short, the high frequency trading (HFT) literature shows that trading advantages measured in milliseconds (or even microseconds) are economically valuable, so two seconds is actually a long time (Budish et al., 2015; Goldstein et al., 2014; Jones, 2013; O’Hara, 2015).\(^3\) The HFT traders we spoke to indicated that, if you receive the information first, the length of your advantage is not very important because positions can be established within several microseconds.

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\(^1\) Fama (1991, p. 1607) writes that “(t)he cleanest evidence on market-efficiency comes from event studies, especially event studies on daily returns. When an information event can be dated precisely…event studies can give a clear picture of the speed of adjustment of prices to information.”


\(^3\) A millisecond is one thousandth of a second; a microsecond is one millionth of a second.
We use Form 4 filings that report insider trades by officers and directors to provide detailed evidence on the process through which public company filings are disseminated by the SEC’s EDGAR system, and so become publicly available. We address three research questions. First, we ask whether the EDGAR system provides some market participants with access to filings before they are made publicly available by posting to the EDGAR website. Second, to the extent these market participants do have early access to filings, we ask whether this advantage allows them to earn economically significant returns by trading on the news. Third, to the extent that early access provides a material trading advantage, we examine whether the length of that advantage matters or whether it is sufficient simply to have the news before other traders.

While the casual observer may assume that the EDGAR dissemination process is effectively instantaneous, we show that in fact the process—from upload to posting—typically takes around 36 seconds (median). We further show that the news is available to certain intermediaries and investors before it is posted to the public SEC website: for 57% of insider purchases, filings are available to at least one PDS (Public Dissemination System) subscriber before they are posted to the SEC EDGAR website.\(^4\) This proportion is a lower bound on the relative frequency of private advantage because we have data from only one of approximately 40 PDS subscribers.

We show that prices, volumes, and spreads move 15-30 seconds in advance of when the news is posted to the SEC EDGAR site. We also show that, when the PDS feed is first and there are trades in both the private and public windows, a return of 28 basis points (during an average 81 second window) is available to the informed traders, an economically significant quantity for HFT firms.\(^5\) This implies that the process through which filings are disseminated via EDGAR provides certain

\(^4\) We provide details on EDGAR and the PDS in Section 2. Our data are from a single PDS subscriber that receives two feeds. We show that at least one of these feeds “beats” the SEC post time in 57% of cases for insider purchases, and that both of the feeds beat the SEC post time in 53% of cases. Numbers are very similar for insider sales.

\(^5\) There is evidence that HFT margins are very small, and that these firms make money by trading large volumes very quickly. Goldstein et al. (2014) report that an HFT firm makes only 0.1 cents per share traded.
intermediaries and their clients with a timing advantage and that some market participants trade and profit on this advantage.

We focus on Form 4 filings of insider trading information because these filings are simple, relatively homogeneous disclosures that are informative to market participants, and because the implications for price are clear without the need for additional information or analysis, which facilitates our tests of trading advantage. There is evidence that filings reporting insider purchases result in positive abnormal returns at the release date (Brochet, 2010). Furthermore, prior studies show that prices continue to drift upward after the filing so that outsiders earn abnormal returns from trading on news about insiders’ trades (e.g., Jaffe, 1974; Seyhun, 1986; Jeng et al., 2003; Lakonishok and Lee, 2001; Ravina and Sapienza, 2010; Jagolinzer et al., 2011; Cohen et al., 2012). It is also well known that insider sales convey less information (Brochet, 2010; Rogers, 2008), so our market tests focus on insider purchases.

In contrast to insider transactions, other types of filings such as earnings announcements (reported on Form 8-K filings) and periodic reports (reported on Form 10-Qs and 10-Ks), are often preempted by other, more timely sources of information, which means that they are less likely to move prices. As a result, the pricing implications are less clear a priori, which hinders price tests of pre-event information leakage, an important part of our analysis. Moreover, it is possible that the timing of these filings is strategically managed as part of managers’ disclosure and reporting strategies, potentially complicating our analysis, which is focused on understanding the mechanics of the SEC’s dissemination process. Nevertheless, when we extend our baseline analysis to include other filing

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6 Form 4 filings convey the company name and symbol, identity and role of insider, date of trade, trade type, trade size, trade price, total trade value, and total holdings of the insider.

7 Seyhun (1986) reports cumulative abnormal returns of 3.0% over the 100 days after insider purchases. Using a sample drawn from 1986 to 2007, Cohen et al. (2012) show that the abnormal returns associated with the trades of “opportunistic” insiders (who are more likely to trade based on information) are 9.8% on an annualized basis and accrue over 12-month period after the trade.
types (including 8-K, 10-Q, and 10-K filings), we again find that, in the majority of cases, these filings are available to at least one PDS subscriber before being posted to EDGAR.

Market participants that subscribe to the PDS feeds are unlikely to trade on all filings, but instead use sophisticated algorithms to identify more informative insider trades (e.g., those most likely to move price). Rather than trying to guess how the algorithms work, we look at actual trade activity to identify filings that are most likely to have been traded on by a PDS subscriber. Specifically, we identify filings with at least one trade immediately around the time of the PDS feed but before the SEC post (private trade) and at least one trade within a minute after the SEC posting (public trade). Of the average 101 bps accruing between the acceptance of a Form 4 by the SEC and the close of the market that day, we find that approximately 28% of this return is only available to privately advantaged traders. Specifically, the average return (first public trade price minus first private trade price deflated by private trade price) between the first private trade and the first public trade is 28 bps. These returns occur over an average (median) of 81 (49) seconds and are likely to be economically meaningful to HFT traders.

In robustness tests, we also find a private advantage outside of market hours. Prices respond in advance of the SEC posting with even larger returns (based on quotes) relative to the within market hours sample. However, as expected, markets are substantially less liquid in the after-hours market

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8 For these trades, prices continue to drift by another 160 bps over the next nine days. This additional return is available to outsiders trading on public news. Given the HFT preference for short holding periods, we focus on the filing-day return.

9 Returns can be measured using transaction prices from actual trades or the midpoint of quotes; we use both approaches in this paper. Quotes are available for every second of the trading day making them convenient for short window return tests when trading may not occur. As a result, we use quotes when our tests do not require actual trading. Trade-based returns are useful for knowing the actual transaction prices at different points in time. As a result, we use actual trades when our tests require actual trading. Trade-based returns can be affected by “bid-ask bounce” (e.g., one trade is buyer-initiated and executes at the ask and the next trade is seller initiated and executes at the bid). Given returns after insider purchases tend to be positive and drift upwards for at least several days, we expect traders to be purchasing shares after both private and public signals. Therefore, we do not expect bid-ask bounce to affect our results.
and the volume response, while ahead of the SEC posting, is muted compared to our results for filings made during the trading day.

Our paper makes several contributions. First, it shows that the SEC’s process for the dissemination of insider filings (and other types of filings) is not a level playing field: certain market participants have access to insider trading filings submitted to EDGAR before others, and prices, volumes, and spreads move in the direction of the news in advance of it being posted (and publicly-available) on EDGAR. The basic technology underlying EDGAR had been in place for a number of years without significant updating. Our evidence suggests that the SEC’s technological infrastructure has simply not kept pace with the technological capabilities of traders and other market intermediaries.10

Second, in a market environment where milliseconds (or even microseconds) provide material advantage, how information is disseminated to market participants matters more than was the case when trading took place more slowly through a centralized market-making function, and muddies the definition of what it means for information to be ‘publicly available.’ As our research demonstrates, it is technologically difficult to ensure that all market participants receive information simultaneously. As a result, how companies release and disseminate news through various channels, including their own websites, conference calls, the business press, via social media, etc., matters more today than ever before. Thus, research that examines the details of how corporate news is disseminated, including

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10 Our paper, along with contemporaneous work by Jackson and Mitts (2014), was prominently covered in a front page article in the Wall Street Journal on Oct 29, 2014, in a story that publicized the fact that EDGAR provided PDS subscribers with a timing advantage (“Fast Traders Are Getting Data From SEC Seconds Early,” Wall Street Journal, October 29, 2014). Our interactions with the SEC in the early fall of 2014 suggest that it was not aware of the timing advantage available to PDS subscribers prior to seeing our paper. On December 19, 2014, Mary Jo White, the SEC Chair, announced plans to enhance the system to “ensure that EDGAR filings are available to the public on the SEC website before such filings are made available to PDS subscribers” and that these enhancements were expected to be in place in the first quarter of 2015 (refer to the letter from SEC Chair, Mary Jo White, http://freepdfhosting.com/1f49e3046a.pdf). See also “SEC plans to fix flaw in distribution system,” Wall Street Journal, December 26, 2014. The EDGAR Public Dissemination Service – New Subscriber Document (version dated February 23, 2015 at page 3) now contains the following statement “(t)he SEC may process the EDGAR data for the SEC website prior to transmitting the data to the PDS.”
Blankespoor et al. (2014), Bushee et al. (2010), and Rogers et al. (2016), is likely to become increasingly important in understanding how markets assimilate information. For example, while we show significant movement in prices, volumes, and spreads before insider news becomes publicly available, Rogers et al. (2016) show that there are nevertheless incremental market effects when Dow Jones disseminates this news, which occurs after it has been posted to the SEC website. This means that it takes time for the market to fully assimilate news, and that the channels through which the news is disseminated affects how this occurs.

Third, our research contributes to the HFT literature, which we describe further in Section 2. Most of this research examines policy questions such as whether HFT affects the functioning of the market microstructure in such a way as to be harmful to market liquidity (e.g., Brogaard et al., 2014; Budish et al., 2015; O'Hara, 2015). Relatively little is known about traders who seek to gain an advantage by obtaining access to news before other traders (Jones, 2013). While some studies show that HFT firms trade based on macroeconomic news (as well as other news that moves the market as a whole), no previous work of which we are aware addresses firm specific news. By providing evidence of time lags in the process through which SEC filings are disseminated, we show that there are significant opportunities for these types of traders to profit by trading on delays in the public dissemination of information. Further, we provide evidence from actual trades that the returns available to HFT firms are economically significant, and that the magnitude of these returns does not depend on the length of the trading advantage. This evidence suggests that HFT firms benefit from having information first regardless of how early it is available relative to the public release time. This confirms the ‘winner take all’ view of HFT generally and explains why these traders seek ever-lower latencies in how they obtain and trade on information.

Fourth, our findings are important for researchers who conduct event studies of SEC filings, especially when these studies use intraday data. Our evidence indicates that these filings become
publicly-available after the time indicated in the filing header and that the time these documents first become available to traders may not be the time they are initially posted to the EDGAR site. Instead, in many instances, filings are made available to some subset of market participants at some point between the header time and the time of posting to the SEC website. While this may not be an issue for studies that use daily event dates, researchers who use intraday event times will need to consider carefully how to measure when the filing becomes publicly-available and exactly what that means—our evidence shows that filing news is not simultaneously available to all market participants.

Contemporaneous work by Jackson and Mitts (2014) confirms our main finding that the SEC’s process for disseminating regulatory filings provides early access to certain market participants. There are two important differences between our paper and Jackson and Mitts (2014). First, they analyze all SEC filings rather than focusing on Form 4 filings and, consistent with our findings, find that the EDGAR process allows certain market participants to access filings before they are available on the EDGAR website. However, along with a PDS feed, Jackson and Mitts use FTP timestamps to proxy for the initial availability of filing information, an important difference from our approach (see Appendix A for discussion). Second, we focus on filings where the expected direction of return is known ex ante (i.e., insider purchases). In contrast, they use ex post returns to partition their data into good news and bad news, making it difficult to determine whether investors could actually earn the returns they calculate.

The next section summarizes the HFT literature, provides more details about the EDGAR dissemination process, and presents our research questions. Section 3 describes the data and sample. Section 4 presents our evidence on the timing of the dissemination process while Section 5 presents evidence on the market response and the returns available to advantaged traders. Section 6 concludes and discusses implications.

2. Our Setting and Research Questions
2.1. High Frequency Trading

There is now a substantive literature in finance and economics that addresses various aspects of high frequency trading (HFT). We focus on the implications of this research for our setting and research questions. As described by O’Hara (2015) and Jones (2013), the term high frequency trader actually encompasses a number of different trading processes and strategies, the common elements being that trading 1. Is done by computers, 2. Is extremely fast (O’Hara mentions speeds, or more correctly, latencies, measured in milliseconds, microseconds, or even nanoseconds), 3. Exploits co-location (to minimize latencies; for example, HFT firms that trade US equities are typically located in New York City), and 4. Is strategy-based. Goldstein et al. (2014) point out that HFT represented less than 10% of trading volume on U.S. equity markets in the early 2000s but that this had grown to around 50% by late 2012. Easley et al., 2012, quote a source that indicates that HFT accounts for 70% of the volume on US equity markets since 2009.

A large part of the literature addresses whether HFT is beneficial, and so addresses questions related to liquidity and price discovery. As O’Hara (2015, p. 259) indicates, there is “general, but not universal agreement that HFT market making enhances market quality by reducing spreads and enhancing informational efficiency.” Hendershott et al. (2011) characterize HFT as a subset of algorithmic traders and conclude that HFT improves price efficiency.

O’Hara points out that in a high frequency world, the definition of fundamental information becomes blurred because of the speed of trade. While informed traders still look to profit from information, and other traders seek to learn what informed traders know from market data, the rise of algorithmic trading by machines means that the underlying orders are information rather than the trades themselves. She points out that microstructure models typically define private information as

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a signal of the asset’s underlying fundamental value but that when trading intervals are measured in milliseconds, information can be order-related as well as asset-related.

For purposes of our work, there are three important implications of this work. First, the HFT literature indicates that some HFT firms trade on fundamental news, but this is only one of several business models. Goldstein et al. (2014) describe four broad types of HFT trading activity: 1. Automated liquidity provision (passive market-making); 2. Market microstructure strategies (“trading the tape”) under which HFT firms trade based on information they extract from the order flow to profit from very short term price changes; 3. Statistical trading, which exploits arbitrage opportunities across different types of securities; 4. Event arbitrage, which captures trading based on releases of both market-wide (including macroeconomic) and firm specific news. Consistent with HFT firms receiving information slightly ahead of the market, Brogaard et al. (2014) provide evidence that HFT firms predict price changes over intervals of 3-4 seconds.

Similar to our setting, to be successful in the event arbitrage business, HFT firms seek to be the first to obtain news that will move prices. Jones (2013) discusses the fact that some HFT firms parse firm-specific news to extract trading signals and take positions on those signals within milliseconds of the information becoming available. However, while the literature suggests that HFT firms likely exploit firm specific news, there is no direct evidence of such trading. In attempting to understand the fundamental information used by HFT firms to trade, Brogaard et al. (2014, p. 2293) focus on “three types of information identified in prior literature: macroeconomic news announcements, market-wide returns, and imbalances in the limit order book” but do not test whether HFT firms base their trades on firm specific news.

Second, HFT firms make money by engaging in very high volumes of transactions very quickly; margins on any particular transaction are usually very small. Goldstein et al. (2014) indicate that the typical net profit margin for a HFT in US equity markets is only 0.1 cents per share traded.
Generating even these margins necessitates being faster than other firms to predict and trade on very short-term movements in price or order flow.

Third, HFT activity is strongly related to firm size. Brogaard et al. (2014) use actual trading data by HFT firms in 2008 and 2009 and report that HFT accounts for 42% of the volume in large stocks and 18% of the volume in small stocks. They observe that the reasons for this are not obvious.

2.2 The EDGAR dissemination process

The current disclosure regime for Form 4 filings dates from 2002. In that year, the SEC changed its regulations to require that insider transactions be reported within two business days of the trade. Before this, insiders had up to ten days after the end of the calendar month of the transaction to report the trade, so that trades were often not reported for a month or more (Seyhun, 1986). In June 2003, the SEC required that insider filings be made electronically using EDGAR, so that the information is quickly available to outside investors.

Figure 1 summarizes the EDGAR dissemination process (during the period for which we have data) based on publicly available documents obtained from the SEC website.12 We supplement the information in Figure 1 with conversations with SEC personnel and our data provider (a subscriber to the PDS system). The SEC site describes the EDGAR Public Dissemination Service (PDS), which aims “to provide the public an accurate, complete and fast method of obtaining all accepted and valid EDGAR filings.”13 A private vendor runs the PDS; the vendor during the period for which we have data (March 2012 through December 2013) was NTT Data. Access to the PDS is subscription based,

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12 As noted above, the SEC made changes to the EDGAR/PDS in February 2015, at least in part due to the publicity that resulted from an earlier draft of our study. Except as otherwise noted, the description we provide here is of the system as it existed prior to the changes made at that time and during the period for which we have data.

13 http://www.sec.gov/info/edgar/ednews/dissemin.htm. Last accessed April 15, 2016. The SEC describes EDGAR as follows: “EDGAR, the Electronic Data Gathering, Analysis, and Retrieval system, performs automated collection, validation, indexing, acceptance, and forwarding of submissions by companies and others who are required by law to file forms with the U.S. Securities and Exchange Commission (SEC). Its primary purpose is to increase the efficiency and fairness of the securities market for the benefit of investors, corporations, and the economy by accelerating the receipt, acceptance, dissemination, and analysis of time-sensitive corporate information filed with the agency.” See http://www.sec.gov/edgar/aboutedgar.htm.
with fees set by the vendor; these fees were about $15,000 per year in 2014. EDGAR transmits the filing to both the SEC website (where it is available to the public) and to the PDS. The PDS transmits the data to paying subscribers. According to the SEC’s description of the subscriber service at the time we collected our data, subscribers receive filings that are accepted by EDGAR “at the same time” they are sent to the SEC site, with “real-time transmission” of all valid public documents. Thus, at least in theory, the system operated to ensure simultaneous access for all interested parties, whether or not they subscribe to the system. Our empirical results do not support this theory.

The SEC provides further detail about the dissemination process in “EDGAR Public Dissemination Service – New Subscriber Document,” also obtained from the SEC website. The process begins when EDGAR receives a filing that is submitted by an SEC registrant or other filing party. The document is “parsed” to extract key information, and then run through a “rigorous series of syntactic and semantic validation rules” before being accepted by EDGAR. The document is then “reassembled with informative header tags” before being transmitted to the PDS and the SEC website. The document states that this process “usually takes no longer than two (2) minutes from the receipt of filing submissions to EDGAR.”

Our paper provides evidence on the timeliness of this process, including the extent to which any lags advantage some subset of market participants. Li et al. (2011) provide evidence that the original EDGAR process (circa 1996) had a built-in delay that provided certain intermediaries with a timing advantage of up to 24 hours. This changed in 2002, after which filings were “immediately”

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14 All quotes from EDGAR Public Dissemination Service – New Subscriber Document (Updated Apr. 1, 2013) at page 3. This document was downloaded from [http://www.sec.gov/info/edgar/pdsnewsubscriber.pdf](http://www.sec.gov/info/edgar/pdsnewsubscriber.pdf) on May 14, 2014. The document was subsequently updated (July 1, 2014) with a new vendor, Attain LLC, but the updated document retains all of the language cited in the text. The document was updated again, on February 23, 2015; the SEC website that describes the PDS now states “(t)his document was updated to reflect modifications to the EDGAR system to ensure that EDGAR filings are available to the public on the SEC website before such filings are made available to the public dissemination system (PDS)” (our emphasis).

15 Li et al. (2011, p. 677, note 10) indicate that when EDGAR was first introduced in 1996, Level 1 subscribers had immediate access to filings but filings were not posted to the SEC site (and so did not become publicly available) for 24 hours.
made available to the public, with the then-SEC chairman stating that the change ensured there was a “level playing field” so that investors received “timely information.”

After acceptance, EDGAR transmits processed filings to the PDS and SEC site. Our discussions with SEC staff indicate that EDGAR initially transmits filings to the PDS and waits for an (automated) acknowledgment of receipt. Once that occurs, EDGAR transmits the filing to the SEC site, where it becomes publicly-available. The PDS then begins the process of transmitting filings to the subscribers. According to the subscriber document, transmission to the PDS and the SEC site occurs simultaneously; as we show below, this is not, in fact, the case. The PDS server compresses the documents and forwards them through a firewall to the IP address of the subscribers’ servers. Our understanding is that there are around 40 PDS subscribers, and that the PDS transmits filings to each subscriber feed sequentially in random order (“someone is first and someone is last”). Each of these subscribers has the option of adding a second (equivalent) feed for a marginal cost. Any subscriber who wants to increase their odds of getting the information first is likely to purchase the additional feed.

To proxy for the public release of information, most event studies of SEC filings use the date/time the media disseminates the filing or the acceptance date/time stamp in the header of the respective filing on the SEC public site. This process worked well when using daily returns, with

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16 See “SEC Announces Free, Real-Time Public Access to EDGAR Database at http://www.sec.gov/news/press/2002-75.htm (last accessed April 15, 2016). This release contains the following quote from then-Chairman of the SEC, Harvey Pitt: “This latest improvement to the Commission’s web site will help meet our long-standing goal of providing investors with timely access to information they need to make investment decisions,” Pitt said. "Through this initiative we are continuing to level the playing field for all investors."

earnings announcement studies conventionally using days -1 and 0 relative to the event date as the
event window. For intraday analyses, studies typically use the Dow Jones News Service release time,
which provides the time (hour and minute) when the news is transmitted by the news wire service.
These proxies for the public-availability of the news contained in SEC filings are reasonable given the
questions being asked in these studies (do returns respond to earnings news?) and available data (daily
returns or minute-by-minute data for intraday studies). However, given the advent of HFT, it has
become necessary to partition the event window more finely. We consider four different points in
time, three of which we obtain from a PDS subscriber:

1. EDGAR acceptance time (the time the filing is accepted by the EDGAR system). As
discussed above, acceptance occurs after EDGAR performs certain rudimentary checks on
the filing so some time (presumably very short) elapses between when the filing is submitted
and when it is accepted. The acceptance time is the “official” EDGAR time stamp that we
scrape from the header text of each Form 4 filing in EDGAR.

2. Filing received by PDS Subscriber Feed #1.

3. Filing received by PDS Subscriber Feed #2.

4. Filing first posted to SEC public site https://www.sec.gov/edgar; we refer to this time
henceforth as “posting.”

Our data for times 2.-4. are from a PDS subscriber. Our understanding is that subscribers for
whom the timing is crucial obtain a second feed because technical issues sometimes slow
dissemination via a given feed (as indicated above, the PDS transmits filings to subscribers

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18 As far as we know, this time is not available on any publicly-available database. We initially obtained these times using
real time “scrapes” of the SEC EDGAR site. We subsequently obtained and used a collection of these times that had
been retained by the PDS subscriber for the same window as the PDS feeds they provided us. They obtained these times
by scraping the SEC website. Given that this entity’s business model depends, at least in part, on obtaining and
disseminating these filings in the timeliest manner possible, they have strong incentives to collect accurate information
about when filings become available on the SEC website. In addition, the spike we find in the market response at the
second of the scrape time when the SEC post time is the first dissemination gives additional support that we have an
accurate time for the posting.
sequentially, so having more than one feed hedges against the possibility that a given feed is towards the end of the queue). While our subscriber data refers to “Feed #1” and “Feed #2” and the SEC’s New Subscriber Document refers to “Primary” and “Secondary” feeds, the feeds appear equivalent in our data in that one is not systematically before the other. Each feed is first for approximately 31% of the filings and they are tied for the remaining 38%. Figure 2 presents the distribution of the timing differences, in seconds. The PDS subscriber tracks the two PDS feeds and the SEC posting at the millisecond level. We round each of these measures down to the nearest second for all of our tests. We note that having two feeds provides a substantial advantage because when the feed times differ they often differ by more than a few seconds.

### 2.3 Research questions

Based on the foregoing, our tests address three research questions. First, do PDS subscribers obtain a timing advantage vis-à-vis investors who obtain filing information from the public SEC site? To answer this question, we first provide evidence on the time (in seconds) between when EDGAR accepts a filing and when it is posted to the SEC site. To the extent there are delays in this process, we examine factors that explain variation in the delays, including whether “busy” periods (with large numbers of filings) slow the process. We then compare the time a filing is posted to the SEC site to the earliest of the two PDS feeds, which is our proxy for private availability to PDS subscribers and their clients. Given our data provider will typically not be the first (i.e., receives the filing after other PDS subscribers), this timing will be biased late in many cases. We use the term “first dissemination”

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19 We round down to the nearest second and consider the feeds tied if the rounded times are the same.
20 Rounding down provides assurance than the information releases did not come before event time \( t = 0 \) (assuming the TAQ and PDS subscriber clocks are synchronized). If we alternatively rounded to the nearest second, PDS feeds received in the latter half of the second would be rounded up (e.g., a document received at 10:05:02.57 would be rounded to 10:05:03.00). In a world where some traders can react almost instantaneously, the price, volume and spread at 10:05:03.00 may already reflect their trading activities. Rounding down ensures that the \( t=0 \) price, volume and spread has not moved as a result of their trading on this PDS feed. Note that certain of our results, discussed below, provide assurance that the TAQ and PDS clocks are synchronized.
to denote the earliest of times 2., 3., and 4. above; that is, the first time the information is available to our PDS subscriber via either a PDS feed or the SEC site.

Second, to examine whether PDS subscribers (and their clients) benefit economically from any timing advantage they may have, we provide evidence on whether these parties obtain an economically significant trading advantage by obtaining early access to the filings. To do this, we analyze intra-day (second-by-second) price, volume, and spread data to see whether the market responds to the insider trade news before it is posted to the SEC site and becomes publicly available. We then simulate trading strategies actually available to informed market participants such as HFT firms. Specifically, for those instances when the filing is available to PDS subscribers before other market participants (‘PDS 1st’), we identify observations for which there are actual trades made at around the time the news becomes privately available to PDS subscribers (private trade) and after the news becomes public (public trade). Under reasonable assumptions, this allows us to compute intraday realized returns available to informed traders and so assess the economic magnitude of these returns.

Third, to the extent we find that early access to public news provides certain market participants with a material trading advantage, we examine whether the length of the timing advantage matters. While it may seem that a longer advantage would naturally be more valuable, our discussions with high-frequency traders suggest that any timing advantage is valuable given their ability to take positions almost instantaneously, and that there are large returns to being the winner (the one who gets the information first). We thus use our setting to examine whether the returns available to advantaged traders relate to the magnitude of their timing advantage. This is consistent with anecdotes from the HFT literature, which indicate that HFT firms and the intermediaries that cater to them are in an ongoing arms race to reduce the time it takes to access information, so that they can be first.
3. Sample and data

We provide details on how we construct our sample in Table 1. We obtain Form 4 filings from T-R, and exclude options trades and trades made by company insiders who are not officers or directors as well as trades made outside of the period from March 1, 2012 to December 31, 2013 (to allow us to match to the PDS subscriber feed data). This results in 97,398 insider trades: 23,128 purchases and 74,270 sales. We then use the insider name and company CIK to match to the EDGAR filing, which reduces the sample to 88,841 trades. To enable us to unambiguously associate filings with market effects, we remove observations for which there are multiple filings for the same firm within a given five minute window, which reduces the sample to 66,110 trades. We then match to the data from the PDS subscriber, from whom we obtain the two PDS feed times and the SEC post time (no loss of observations).

For our main tests, we restrict attention to trades made between 9:40am and 3:30pm eastern to ensure trades occur during the trading day and avoid beginning and end of day trading effects. This results in the loss of two-thirds of the observations, reducing the sample to 21,004 observations (the majority of trades are filed outside of trading hours). We examine filings in extended market hours for robustness in Section 5.5 and find consistent results but note that the actual trading volume supporting these results is small. We then require TAQ data and that the insider transaction price occurs within the daily trading range indicated by CRSP (to remove obvious data errors), resulting in a final sample of 17,960 observations, of which 4,782 (27%) are purchases.

Table 2 provides descriptive information on the sample, after excluding insider sales. We compare the final sample (Line 6 of Table 1) to the larger set of observations before we impose the trading day restrictions (Lines 3 of Table 1). Variable definitions are in Appendix B. There are significant differences between insider transactions reported within and outside trading hours. Trade size, the extent to which filings “cluster,” and the amount of prior trading by the insider are smaller
for filings made within trading hours even though larger firms are more likely to report during trading hours. Median firm size (total assets) is $678 million for trades reported within trading hours compared to $543 million for the Line 3 sample that includes all trades, with mean differences in the same direction. Median trade size is $16,649 for trades reported within trading hours versus $17,949 for the unrestricted Line 3 sample. The filing cluster variable indicates that a median of two filings are made in the minute before filing for filings made within the trading day compared to three filings made in the minute before filings in the Line 3 sample. Finally, the median prior purchase by the insider is $38,000, but declines to $35,464 for the sample within trading hours.

Compared to other information released by firms, the timing of Form 4 insider trading filings is less likely to be related to the information content of the filing. A large literature examines whether managers strategically time information releases such as earnings announcements. A number of studies examine whether managers strategically delay the release of adverse news to periods when it is likely to receive less attention, including after trading hours (Patell and Wolfson, 1982; Dellavigna and Pollet, 2009; Doyle and Magilke, 2009; Niessner, 2014).

Our understanding is that most firms have stringent policies that govern various aspects of trading by corporate officers and board members, and that companies typically handle Form 4 filings in a routine way to ensure compliance with SEC filing requirements (Bettis et al., 2000; Jagolinzer et al., 2011). Consequently, we do not believe that companies or managers strategically manage the timing of Form 4 filings on the basis of their information content (other than, perhaps, to avoid “busy” times or routinely file after trading hours). The evidence discussed above, for example, shows that larger firms are more likely to file Form 4s during trading hours and that larger trades tend to be reported outside of trading hours.

4. Evidence on timing of dissemination
As discussed above, the SEC requires Form 4s to be filed within two business days of the insider’s trade. Consistent with this deadline, we find (but do not tabulate) that insiders typically file Form 4s within one day (median), consistent with Brochet (2010). The mean is larger (4.0 days) because there are some large outliers; the 99th percentile is 37 days.

To address our first research question, Table 3 reports on the time differences between when the filing first becomes publicly available on the EDGAR website (the SEC posting time) and when it is first transmitted to the PDS Subscriber (the time of the earliest of the two PDS feeds). This table reports the distribution of these time differences bucketed in five second increments.

We tabulate the data for purchases; results for sales are very similar. In the first column, negative differences indicate that the earliest PDS feed occurs before the SEC post, meaning that PDS subscribers had the data before it was posted to the SEC site and became public; conversely, positive differences indicate that the PDS feed comes after posting to the SEC site. Of the 4,782 purchases, 57% are available to the PDS subscriber via one of the PDS feeds before SEC posting; the corresponding fraction for sales is 56% (untabulated). Thus, in the majority of cases the filing is available to PDS subscribers before it is publicly available. These numbers are conservative because we have data for only one PDS subscriber; other PDS subscribers likely obtain the information before our subscriber. When one of the PDS feeds beats the SEC posting it is usually the case that both feeds do so: while 57% of the purchase filings are received by at least one feed before the SEC, 53% are received by both feeds prior to the SEC posting (untabulated). When we replicate the analysis in Table 3 for the larger sample of filings that includes those made outside of trading hours (the Table 1, Line 3 sample); results are very similar (untabulated).

These delays are likely to be significant in the world of HFT. The timing advantage is less than 5 seconds in 11.5% of cases, from 5 to 10 seconds in 11.0% of cases, and more than 10 seconds in 34.6% of cases. These differences provide more than enough time for HFT firms to profit from
receiving filing information before others, and challenge the notion that the public dissemination process is a level playing field.

There is no expectation here that the PDS feed should always beat the SEC posting time: the system is not intended to provide them with a timing advantage – technically the PDS subscribers pay for access and happen in some cases to gain access before SEC posting. As discussed in Section 2, the SEC’s description of the process indicates that transmissions to the PDS feeds and posting to the SEC site should occur simultaneously.

We next report on the time that elapses from acceptance by EDGAR to posting on the SEC site; see Table 4, Panel A. For the 4,782 purchases, the mean (median) time from acceptance to SEC posting is 40 (36) seconds, with a standard deviation of 24 seconds, indicating there are some large outliers; in some cases, there is a (relatively) long delay in getting the filing posted. It is hard to evaluate these numbers in an absolute sense, except to say that the system processes most filings quickly, in that it typically takes 30-40 seconds for documents to be posted once they are accepted by EDGAR.

If we look instead at the time between acceptance and first dissemination (i.e., the first time the PDS subscriber receives the filing, either from one of its feeds or from the SEC posting), the numbers confirm that dissemination to PDS subscribers often occurs more quickly than posting to the SEC site. The mean (median) time to initial dissemination is 30 (30) seconds with a standard deviation of 10 seconds, as compared to the mean (median) of 40 (36) seconds to initial public posting.

When we directly compute the time of private advantage, from when the PDS subscriber first receives the filing, either from one of its two PDS feeds or the SEC site directly, to when the filing is posted to the SEC site, the mean (median) is 10.5 (3.2) seconds, numbers that are reliably different from zero. Note that for 43% of these observations, the difference is, by definition, zero as the first dissemination is equal to the SEC post. In the final row of Panel A, we show the time differences between the first PDS feed and the SEC posting for the 57% of cases where there is a private
advantage. Here, the average advantage to the PDS feed is 18.2 seconds with a median of 13.0 seconds. In the full sample and the private advantage subsample we see that the standard deviations are 22.5 and 27.3, indicating that the delays between first dissemination and SEC posting are sometimes quite large.

It is unclear why there are delays in the posting of Form 4 filings to the SEC site. Based on our understanding of the process, transmission of accepted filings to the SEC site should occur as soon as the PDS acknowledges receipt, after which it also begins dissemination to the PDS subscribers. To provide some evidence on why postings to the SEC site are delayed relative to their availability to PDS subscribers, Panel B of Table 4 compares attributes of insider purchases partitioned according to whether they are available to PDS subscribers before (PDS 1st) or after (SEC 1st) posting to the SEC site. We compare trade size (log of 1 + total dollars), firm size (log of 1 + total assets, in millions), prior trading by the insider (log of 1 + total purchase activity, in dollars, for that insider during the previous year), a CEO dummy, a CFO dummy, and filing cluster (log of 1 + the number of filings posted to the SEC site in the previous 60 seconds).

With one notable exception, the results provide little evidence of systematic differences in the characteristics of filings available to the PDS subscriber before and after they are posted to the SEC site. The filing cluster variable is larger for observations for which the filing is posted to the SEC site before the PDS feeds arrive, implying that busy periods delay transmission to PDS subscribers more than to the public site; the private advantage is reduced or is less likely to occur in busy times. This impression is reinforced by the regressions we report in Panel C. These regressions use the same variables to explain the length of four time lags: from time of EDGAR acceptance through: 1. posting to the SEC site; 2. PDS feed #1; 3. PDS feed #2, as well as 4. from first dissemination (i.e., when the PDS subscriber first receives the filing from its PDS feeds or the SEC posting, whichever is first) to SEC posting. This last variable is positive when the earliest PDS feed occurs before posting to the
SEC site and zero when SEC posting occurs first. We also include a time trend (months) to examine whether these time lags change systematically over our sample period.

These regressions largely confirm the univariate evidence. The only variable that achieves significance in these regressions is filing cluster, which captures the extent to which a lot of filings are posted to the SEC site in a short period of time (i.e., the EDGAR system is busier). Clusters in filings delay the transmission of the filing to the SEC site and, to a larger extent, to PDS subscribers (all of the first three specifications have a significantly positive coefficient on the cluster variable). Although the clustering slows both the PDS feeds and the SEC posting, it slows the PDS feeds to a greater degree such that it is less likely that the PDS feeds “beat” posting to the SEC site (the coefficient on the cluster variable is significantly negative in the final specification, consistent with a reduction in the timing advantage to PDS subscribers during busier times). For the acceptance-to-SEC regression, the coefficient on this variable is around 5 \( (t = 3.82) \) and the R-squared is 2.4%; in contrast, for the two acceptance-to-PDS feed regressions, the coefficient is around 14 \( (t = 18) \) and the R-squared is substantially higher at 26%. This is consistent with the clustering of filings playing a more important role in delaying feeds to PDS subscribers, both in absolute terms and relative to the time of SEC posting—the PDS process is slower during busier filing periods, reducing the timing advantage of the subscribers. The time trend variable is positive but only weakly significant, indicating a modest tendency for posting delays to get longer over our sample period. In summary, the regressions explain a substantial portion of the variation in the PDS delays (the \( R^2 \) is 26%) with the majority of the variation explained by busy times (i.e., the filing cluster).

In untabulated results, we also estimate a logit on which PDS feed is first and a regression of the timing difference between the two PDS feeds. As noted earlier, each of the PDS feeds is first for

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21 Untabulated regression results also suggest that clustered filings increase the gap between SEC acceptance and the FTP timestamp.
31% of the filings and they are (approximately) tied for the remaining 38%. In the logit specification, only the time-trend shows any significance and there is virtually no predictive ability in the model (pseudo $R^2 = 0.006$). In the OLS specification, none of the coefficients are significant and, again, the model has virtually no explanatory power ($R^2 = 0.001$). Thus, it appears that the two feeds are equivalent and the differences between the feeds is random.

The results in this section establish that, for our sample of Form 4 filings, PDS subscribers receive the filings before they are posted to the EDGAR website (and so become publicly available) more than half the time. To examine whether these results extend to a less restrictive sample of Form 4 filings and to other filing types, we also examine (but do not tabulate) results for a comprehensive set of filings.

Across all SEC filings for our sample period (March 2012 through December 2013) there are 142,443 (261,132) Form 4 filings and 422,454 (385,766) filings of other types made during (outside) trading hours. Similar to what we observe for Form 4s, a large fraction (48%) of other filings occur outside trading hours. For filings made within trading hours, our PDS subscriber receives the filing first 49% (57%) of the time for Form 4 (non-Form 4) filings. For filings made outside of trading hours, the corresponding fractions are 53% (Form 4) and 58% (non-Form 4). Thus, private advantage is not limited to Form 4 filings or to filings made within trading hours.

5. Evidence on trading advantage

5.1 Evidence on timing of the market response to insider filings

We next provide evidence on when the market responds to the information in the filings. For the full sample of 4,782 insider purchases, we use three variables to provide evidence on when the market responds to the insider filing news: 1. Changes in prices (based on quotes) in event time (percent change in price relative to 60 seconds before dissemination), 2. Cumulative abnormal volumes
(percent abnormal volume relative to typical volume for the two minutes around the dissemination),
and 3. Abnormal spreads (spread relative to spread 60 seconds before dissemination).\textsuperscript{22} Formal
definitions of these measures are provided in Appendix B. Each of these variables is measured at one
second intervals.\textsuperscript{23} We report these results in a series of figures.

Figure 3 shows how these variables change in event time relative to initial posting to the SEC
site, measured from 60 seconds before posting to 60 seconds after. These two minute windows are,
for the large majority of observations, wide enough to capture the full period from initial acceptance
to dissemination via the last of our three possible dissemination events. To assess the effect of the
timing advantage, we partition observations according to whether they are available to the PDS
subscriber before posting to the SEC site (“advantaged observations”) or not.

We first discuss results for changes in prices (returns) in Figure 3 Panel A. There is a clear
difference between the two sets of observations, with prices moving upward for the advantaged
observations beginning around 30 seconds before public posting and most of the positive return (of
around 0.30\% for the full two minute window shown here) occurring before public posting. In
contrast, for the non-advantaged observations, most of the upward shift in price occurs exactly at the
time of the posting, with a small upward movement in the few seconds before and additional drift in
the seconds after.\textsuperscript{24} The overall price change over the full window is very similar for the two series,
suggesting that the information content of the trades is similar (this is also confirmed by return
comparisons in Table 5). The differences between the two series from at least 30 seconds before

\textsuperscript{22} We take cumulative dollar volume from $t = -60$ through event second $t$ minus the average volume for the exact same
window (calculated over the previous 52 weeks), deflated by the average cumulative volume for the entire 120 second
window (again calculated over the prior 52 weeks).

\textsuperscript{23} Our tests assume that the clocks used by our PDS subscriber and by TAQ are correctly synchronized. This seems
reasonable based on the importance to the PDS subscriber of having extremely accurate measurement of time for the
Form 4 filings. The tests also assume that there is no delay in recording the quotes using TAQ and (later) trading volumes
and spreads. The quote assumption is inconsistent with early work in the microstructure literature (Lee and Ready, 1991)
but is supported by more recent tests (Rogers, 2008).

\textsuperscript{24} The fact that we see this sharp spike at the time of posting provides strong assurance that the measured clock times
used in our tests are accurate.
public dissemination through one second after are statistically significant (Panel D plots t-statistics for differences between the series). These results provide clear evidence that the market moves before public dissemination.

The results for the volume tests reported in Figure 3, Panel B are consistent with those from the returns test. Once again, there is evidence of market response, this time measured as abnormal volume, that begins around 30 seconds before public posting for the advantaged observations but noticeably later for the non-advantaged observations, with a sharp spike at the posting time. And once again, the two series merge within 10-15 seconds after the public posting, suggesting that the overall volume response is similar. As for the price differences, differences in volume are statistically significant from more than 30 seconds before public dissemination until just before dissemination (Panel D).

Panel C presents the spread results. Similar to the previous figures, these results show that spreads reflect information in the trades noticeably earlier for the advantaged observations relative to the non-advantaged observations. The fact that spreads, which capture information asymmetry among market participants, jump sharply for the advantaged observations provides additional assurance that the effects we capture are information-based and that some traders gain a temporary advantage.

Overall, these results present clear evidence that the market responds over a period of about 30 seconds before public posting for the advantaged transactions, consistent with information leakage occurring through the PDS. In contrast, most of the response occurs exactly at the time of public posting for the non-advantaged transactions. Our evidence indicates that the playing field is not fully level, at least for a short time.

An alternative approach to show the effect of timing is to report the price, volume, and spread changes using different definitions of event time. The next set of tests define time 0 alternatively as:
1. Public posting to the SEC site (“Public Time”), or 2. When the PDS subscriber first receives the information, either from the PDS feeds or the SEC posting (“1st Dissemination Time”). The idea is to infer graphically from the event plots which of the times is the information event, as measured by the most pronounced “spike” at time 0.

The results of the price test (Figure 4 Panel A) support the idea that the important informational event is when the filing becomes available to the PDS subscribers, as opposed to when it is posted to the SEC site. There is a sharp, distinct price response at time 0 when we define the event as 1st Dissemination Time (the earliest receipt by our PDS subscriber from the PDS feeds and the SEC posting). While there is also a time 0 effect when we define the event as the Public Time, it is evident from this plot that a significant portion of the response occurs before time 0, consistent with leakage via the PDS channel.

The volume results in Figure 4 Panel B as well as the spread results in Panel C confirm the price results. The most pronounced time 0 spike occurs when time 0 is defined as when the news is first available to PDS subscribers. In contrast, a good part of the reaction occurs before time 0 when it is defined as the SEC post time, with something of an incremental spike at time 0, suggesting that there are at least some observations for which SEC post time is when the news is first available.

While most of the response occurs at or before time 0, the price and volume charts nevertheless show continued “drift” upwards in prices and volume after the event. Thus, the market adjustment process continues after the end of this two minute window. Indeed, the evidence from Table 5 suggests that while we clearly document a strong price and market response in this short period, this response continues through the end of the trade-day and beyond. This drift is consistent with previous evidence on the price movements associated with insider purchases, which shows that the upward drift in prices continues for weeks and months after the time of the trade.

5.2 Evidence on the value of private advantage
The results to this point indicate that while the SEC processes filings quickly, typically in about 36 seconds, PDS subscribers have access to more than half of all filings before they are posted to the SEC site. We also show that the market responds to the filings before they are posted to the SEC website, consistent with some traders trading on this news before it becomes publicly available. We next estimate the economic value of this advantage.

To estimate the economic magnitude of the private advantage available through a PDS feed, we begin with the understanding that parties subscribing to the feeds are unlikely to trade on all filings, but rather use algorithms to isolate more informative filings (i.e., those most likely to move the market price). Rather than trying to guess how the algorithms work, we look for actual trades to identify filings that are most likely to have been traded on by a PDS subscriber. Specifically, we identify filings with: 1. At least one trade close to the time of the PDS feed but before the SEC post (private trade), and 2. At least one trade within a minute after the SEC posting (public trade).

Ideally, we would observe when the first PDS subscriber receives their feed and look for a trade right after that time; however, we only have data from one PDS subscriber with two feeds. To provide some insights into how much earlier the first feed is likely to be, we use our two feeds to simulate the PDS timing distribution across all subscribers. As we noted earlier, our feeds are received at the same second (when receipt times are rounded down to the nearest full second) 38% of the time, and Feed #1 and Feed #2 are each first 31% of the time. It has been reported that there are approximately 40 subscribers and each subscriber has the option of purchasing an additional feed. If we assume that 50% of the subscribers purchase the extra feed, then there are 60 feeds. In a world with no exact ties and random ordering of feeds, a single feed would be the earliest 1.7% (1/60) of the time, while a subscriber with two feeds would be earliest 3.33% (2/60) of the time.
We use a simulation to determine the expected difference between the earlier of our two feeds and the earliest of the other 58 feeds. Given the size of the timing differences between our two feeds, the median estimated difference between our fastest feed and the fastest feed of the other 58 subscribers is 8.4 seconds. This simulation allows us to estimate how many seconds before our earliest PDS feed we should look for a trade. Based on our estimates, if we go back 10.9 seconds from our earliest feed, we will be before 95% of the other feeds virtually all of the time (99% of the time).

Alternatively, one can use price movements to detect private information-based trading. In untabulated results, we find that the price movement becomes significantly positive on average nine seconds before our first PDS feed. This alternative approach confirms the need to examine trading before our first PDS feed.

Based on this, we look for the first trade beginning 10 seconds before our earliest PDS feed through the time of SEC posting to identify the first trade likely made based on PDS feed information (we evaluate alternative windows for robustness). Having done this, we evaluate the return between the first PDS trade and the first trade occurring within 60 seconds after the SEC post.

Table 5 provides various return measures and other statistics for various subsamples of the set of 4,782 purchase observations. We first divide these observations into those for which the SEC posting occurs before the first PDS feed (denoted $SEC\ 1^a$, 2,054 non-advantaged observations) and those for which one of the two PDS feeds is first ($PDS\ 1^a$, 2,728 advantaged observations). We then use the logic identified above to divide these 2,728 observations into those for which we observe at least one likely advantaged trade ($PDS\ 1^a - 10\ sec, \ trade$, 1,065 observations) and those we do not ($PDS\ 1^a - 10\ sec, \ no\ trade$, 1,663). We compare the characteristics of these observations to determine whether they differ in ways that we expect if PDS subscribers (or their clients) identify more informative

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25 After calculating the time differences between our two feeds across all purchase observations in Line 6 of Table 1, we randomly draw 60 time differences with replacement from our population to estimate the distribution of PDS time differences around a single filing. We repeat this process 1,000 times.
transactions, as expected if HFT firms use this information to trade. First, we compare the size of the insider trade (larger trades are more likely to be informative and hence profitable). Second, we follow the method used by Cohen et al. (2012) to separate insider trades into those that are “routine” (i.e., trades that are less likely information based) and “opportunistic;” we expect privately advantaged traders to focus on potentially more profitable “opportunistic” trades.\footnote{Similar to Cohen et al (2012), we classify a trader as a routine trader if they trade in the same direction (buy or sell) and the same month for the three past years.} We compute returns over various windows to assess the magnitude of the returns available to these traders.

First, there are no reliable differences between the subsets of filings for which the SEC posting occurs before or after the first PDS feed in Table 5. The mean (median) return from the insider trade to acceptance by the SEC is 57 (6) basis points when the SEC is first and 30 (5) bps otherwise; these differences are not statistically significant. The mean (median) return from SEC acceptance through the end of the trading day is 62 bps (35 bps) when the SEC is first and 57 (34 bps) otherwise, differences again not statistically significant. If we consider a longer window to get a longer perspective on profitability, the return for the period from SEC acceptance through the first ten trading days after EDGAR filing, the mean (median) returns are 236 bps (133 bps) for the SEC first sample and 265 bps (123 bps) otherwise; once again differences are not statistically significant. These returns are also roughly in-line with those observed in longer windows in previous research. Finally, both trade size and the percentage of routine trades are similar across these two main subsamples, with no statistically significant differences. These comparisons indicate that the information content of filings does not vary with whether it is received by the PDS feeds first or posted to the SEC site first.

Our main interest is in comparing the subsets of the observations for which the PDS subscriber receives the filing before it is posted to the EDGAR site. Here we observe differences in
the directions we expect if privately advantaged traders identify more informative transactions. Trade size is significantly larger for observations where PDS is first and we observe trades in the relevant window: for this subset of 1,065 observations, mean (median) trade size is 214,400 (50,000) shares compared to 35,617 (9,000) shares, differences that are statistically significant at better than 1%. In addition, these trades are significantly less likely to be routine: 5.4% of these trades are routine for the trade subsample compared to 12% for the non-trade subsample; once again, differences are statistically significant at better than 1%. This evidence suggests that privately informed traders trade on what are likely to be the most informative and therefore profitable insider trades.

Further confirming this interpretation, the mean return from SEC acceptance to the end of the trading day for the trade subsample is 101 bps versus only 30 bps for the no-trade subsample, differences that are again highly significant (medians are 58 bps and 18 bps, respectively, and are also significantly different).

Finally, we compute a mean (median) privately advantaged return of 28 bps (13 bps), which is the return between the first “private trade” and the first trade following the SEC posting. This is approximately 28% of the announcement day return (return from SEC acceptance to the close of day price) and occurs in a short period of time; the mean (median) holding period for this return is 81 (49) seconds. This would seem to be an economically significant private advantage to trading on the PDS feed.

For robustness, we examine alternate windows of five and two seconds prior to the earliest PDS feed. Using shorter windows increases the probability that we miss the first PDS feed and, thus, the first trade based on the PDS information. When we limit the window to five seconds, we have 1,039 observations with an average private return of 25 bps. These 25 bps are earned in a mean (median) of 81 (49) seconds. At a two second window we have 1,023 observations and an average private return of 23 bps. These 23 bps are earned in a mean (median) of 81 (49) seconds.
One way of calibrating the magnitude of this return is to compare it to the returns reported in other research. Dong et al. (2015, Fig. 1, p. 2244) report minute-by-minute returns around the public dissemination of earnings announcements. For the pre-Reg FD sample (during regular trading hours), when sophisticated market participants received access to earnings news 15 minutes early, they show a one-minute absolute return of 17 bps. The return that we report above, of 28 bps for an average holding period of 80.6 seconds, seems comparable to their effect. The 28 bps we report corresponds to 28% of the first day return (101 bps). The number they report corresponds to 51% of the two-day return window.

Another way to gauge the economic significance of our result is to estimate the actual dollar return available from taking a position in the stock based on the private information. For the 1,065 observations in Table 5 with privately advantaged trading there are an average of 30 trades (per observation) corresponding to a total of 7,400 shares ($90,000) in the private window. These 30 trades will likely execute at a number of different transaction prices. Practically speaking, HFT firms will not unload these 7,400 shares in a single transaction after public dissemination; on average, it takes approximately four minutes before the public volume equals the private advantage volume. During these four minutes prices continue to evolve. If all of the purchasers in the private advantage window sold as soon as possible in the public window, their profits would equal the weighted average public transaction price minus the weighted average private transaction price multiplied by the 7,400 shares. This calculation yields an average of $826 per transaction, yielding $880,000 across the 1,065 observations we investigate.27 While it is not clear to us this figure qualifies as “enormous,” it is economically plausible given it is based on only a small fraction of the approximately 1.2 million filings during this timeframe. As we discuss in Section 2.1, HFT firms trade very large volume expecting to

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27 This calculation ignores transaction costs. To the extent that HFT firms demand liquidity in the private window and provide liquidity in the public window, we expect transaction costs (effect of bid-ask spread and net exchange rebates) to be minimal. See Brogaard et al. (2014) for discussion of HFT transaction costs.
make small profits on each share traded. Goldstein et al. (2014) indicate an average net profit margin for HFT firms of around only 0.1 cents per share traded. Our calculation corresponds to a profit of 11 cents per share.

5.3 The value of longer timing advantages

Our setting provides a unique opportunity to analyze not just the value of a timing advantage but also the potential value of marginal increases in the timing advantage. The theory literature has been interested in whether and when traders are willing to pay for an information advantage. At least since Grossman and Stiglitz (1980), theorists have been interested in the implications of a group of investors acquiring information advantages. Empirically, previous work examines whether early access to news results in unusual volume and price movement before its public release (Irvine et al., 2006; Dong et al., 2015). However, these studies do not observe variation in when private signals are received. In Dong et al., their entire sample has a 15 minute advantage and in Irvine et al., they provide evidence consistent with an advantage but do not know exactly when private signals arrive.

Ex ante, it is not obvious whether the value of the timing advantage increases with its length. While it seems intuitive that a longer timing advantage would allow more time to trade and hence be more valuable, Javers (2013) notes that “(i)n the ultra-fast world of high-speed computerized markets, 500 milliseconds is more than enough time to execute trades in stocks and futures that would be affected by the soon-to-be public news. Two seconds, the amount promised to ‘low latency’ customers [by T-R], is an eternity.” This sentiment is echoed by our discussions with two HFT traders, who argue that what matters is being first rather than the amount of time by which one is first. To test this proposition, we examine whether longer timing advantages translate into larger returns.

Figure 5 plots the return from privately informed trading, measured in the same way as in Table 5, for 100 quantiles of timing delays for the 1,065 observations with at least one privately advantaged trade. The first quantile includes observations with the smallest timing advantage while
the 100th quantile includes the longest timing advantages; we plot the average return for each quantile. It is clear from Figure 5 that there is no relation between the length of the timing advantage and the magnitude of the trading return. Subject to the caveat that we are extrapolating from our observed PDS feeds to the full set, this test provides clear evidence that the length of the timing advantage is not important—what matters is having a timing advantage, not how long that advantage lasts.

5.4 Firm size partition

As discussed in Section 2.1, the HFT literature indicates that trading by HFT firms is more prevalent in large firms than small firms (Brogaard et al., 2014). This provides an opportunity to further test the prediction that HFT firms take advantage of the early release of the insider filings through PDS feeds by trading on the news before it is publicly available. Based on the findings of Brogaard et al. (2014), we divide our sample into two approximately equal groups according to whether the sample firms are above or below median firm size (market value of equity). When we partition our sample by size in this way, we obtain a set of ‘large firms’ with mean market value of equity of $4.2 billion (between Brogaard et al.’s large and medium firms) and a set of ‘small firms’ with a mean market value of equity of $0.08 billion (smaller than Brogaard et al.’s average small firm). Based on the findings from Brogaard et al. (2014), we expect there to be substantially greater HFT activity in our large firms compared to our small firms.

Table 6 replicates the analysis from Table 5 with the large and small firm partition; results for large firms are shown in Panel A and results for small firms are shown in Panel B. For both panels, the fraction of PDS first observations is very similar, at about 57%. Consistent with the notion that HFT firms trade more actively in large firms, we find that the fraction of observations that qualify for our private advantage calculation (PDS first observations with the requisite trades) is substantially

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28 We obtain very similar results if we instead use the dollar value of the trades as well as from regressing either the measured return advantage or the dollar value on the length of the timing delay. None of these tests provide any evidence of a relation between the timing and the magnitude of the returns available to privately informed traders.
higher for the large firm sample (893 observations or 65%) than for the small firm sample (172 observations or 13%). Consistent with the Table 5 results, we find significant differences between the PDS first subsamples with and without trade data in the direction expected—the former group is characterized by larger insider trade sizes and relatively more ‘opportunistic’ trades, again suggesting that traders focus on more informative (and so profitable) trades.

Figure 6 replicates the analyses reported in Figure 3, but for the sample partitioned into large and small firms in the way we describe above. Panel A presents results for returns and Panel B presents results for abnormal volume. For the large firms, differences between the plots for the ‘PDS 1st’ and the ‘SEC 1st’ observations are clear: the plots of both returns and abnormal volume start moving upwards around 30 seconds before SEC posting for the ‘PDS 1st’ observations, while the plots move almost vertically at 0 for the ‘SEC 1st’ observations, which seems to be clear evidence of privately advantaged trading. In contrast, for the small firms these patterns are still evident but not as sharp or pronounced, consistent with what we expect if there is less privately advantaged trading in these firms. However, as seen in Panel C, there is very little volume traded in the small firms. All of this is what we expect if HFT firms use the PDS feed to gain a private advantage and do so to a greater extent for the large firms relative to the small firms.

5.5 Extended market hours analysis

Our main tests focus on filings that occur during regular market hours (after we exclude filings around the opening and closing bells). The market is open for extended trading from 4:00am to 9:30am and 4:00pm to 8:00pm. The SEC accepts filings from 8:00am to 10:00pm. Thus, the weekday period during which the SEC accepts new filings and the markets are open for extended trading is between 8:00am to 9:30am and 4:00pm to 8:00pm. We examine whether our results extend to filings during these windows. Of the 7,496 insider purchase filings made outside of regular trading hours during our sample period, 6,989 occur during extended trading hours. Using the Line 5 and Line 6
data constraints from Table 1, we obtain an extended-hours sample of 5,502 observations. The split between SEC 1st and PDS 1st is approximately even (the SEC is first 49.6% of the time and PDS is first 50.4% of the time).

When we repeat the analysis reported in Figure 3, Panel A, for this set of observations, we obtain very similar results (not reported): there is significant price movement before the SEC post time. However, there is little liquidity during this extended trading period: volume is minimal, with zero control period volume for many of our observations. Thus, while our main results on timing continue to hold outside of normal trading hours, it is not clear whether there is sufficient liquidity for market participants to earn significant returns from their timing advantage.

6. Summary and conclusions

We provide evidence on the timeliness of the EDGAR process used by the SEC to publicly disseminate Form 4 insider filings. The timeliness of this process has become critical with the emergence of traders who can take advantage of very small timing differences, sometimes measured in microseconds, between when information becomes available to different market participants. Although we focus on Form 4 filings, the SEC uses the same dissemination process for all regulatory filings, and the timing advantages extend to other filing types.

Our evidence, based on a sample of Form 4 insider trading filings in 2012 and 2013, shows that EDGAR processes these filings quickly, with around a 40 second lag between when filings are accepted by EDGAR and when they are made available to the public on the SEC website. We also show that PDS subscribers, who pay for direct access to EDGAR, receive filings before they are available on the SEC website more than half of the time (in 57% of cases for insider purchases and in 56% of cases for insider sales). The average period of private advantage is about 10 seconds for the full sample and 18 seconds for the subsample of filings where the PDS feeds are before the SEC
posting, a relatively long time in the world of high frequency trading. We report evidence—from prices, trading volume, and spreads—that the market responds to the news in advance of its public release. All three measures begin to move up to 30 seconds before the filing is made available on the SEC site. These findings are hard to reconcile with the notion that the EDGAR process provides a level playing field to investors.

Based on reasonable assumptions, we provide evidence that these timing advantages translate into economically material trading profits. First, we report evidence that traders identify the most informative of those filings they access early. Second, we show that these trades generate trading profits that average around 28 bps over an 81 second period, which we view as economically significant for HFT firms. Finally, we show that the profitability of these trades does not depend on the length of the timing advantage—what matters is getting the information early, not how much of a timing advantage one has.

Our study raises questions about the meaning of publicly available information in a high frequency, low-latency world, where trading advantages are measured in milliseconds. In particular, our findings raise important questions for firms and regulators about how information should be disseminated in today’s capital markets, especially if the goal is to maintain a ‘level playing field’ for all participants.
References


Appendix A: Discussion of contemporaneous working papers and FTP times

FTP Times – Data collection

When a firm submits a filing to the SEC, the file is uploaded to the SEC’s FTP site. According to Jackson and Mitts (2014, JM) “after filings are posted to the FTP site, a private third party, through a system known as the public dissemination service (PDS), distributes the filings to selected investors before the filings are released to the public” (page 1). Jackson, Jiang, and Mitts (2015, JJM) also focus on the potential importance of the FTP server and use the “FTP timestamp as a proxy for the time advantage of the ‘early informed’ in order to preserve a large sample” (page 8). The claim raises several important issues. First, if all filings were indeed publicly available on the FTP server prior to being disseminated to paying PDS subscribers, one might argue that the SEC has (at least theoretically) provided a level-playing field (i.e., anyone with a computer and some programming knowledge could technically be the first person to find a new filing). Second, researchers would not need access to private PDS feeds when researching HFT around EDGAR filings.

While public documents, JM, and JJM all provide some information about the FTP timestamps, it is difficult to know exactly what the timestamps represent. Therefore, we evaluate whether the FTP time is a reasonable approximation for our PDS times and whether it could influence our findings. To begin, we scrape the FTP date-times from the FTP server for each Form 4 filing in our Line 6 sample from Table 1 (4,758 observations). The FTP timestamp represents the last time a file was saved (i.e., the original dates and times are overwritten if a filing is subsequently updated or amended by the firm). In light of the overwriting of the date-time field by amendments, we merge the FTP dates with the SEC acceptance dates and find that 1.9% of the sample (89 observations) has an FTP date that is not the same as the SEC date. In all 89 cases, the FTP date is after the SEC acceptance date, consistent with the date-time being overwritten due to an update or amendment. We drop the 89 observations (i.e., excluding the largest outliers) leaving us with 4,669 observations where the FTP date is the same as the SEC accept date.

FTP time versus alternate times

We next compare the FTP times to four times – SEC accept, first dissemination, first PDS and SEC post. Table A1 shows the differences between the FTP time and each of these alternative times, in seconds. Panel A shows the signed differences, in seconds. Consistent with JM and JJM, we use positive time differences to indicate that FTP time is earlier. Panel B shows the absolute differences, in seconds. The evidence suggests that the FTP timestamp is not a precise proxy for any of these four measures. While the FTP timestamp is before the SEC posting in the majority of cases (73.7%), it tends to be after the other data sources. If a trader could instantaneously find filings on the FTP server, he or she would beat our proxy for first dissemination 36.5% of the time. Of the four times, the closest time to the FTP is actually the SEC post – the mean (median) FTP time occurs 17 seconds after (1.1 seconds before) the SEC post and has a mean (median) absolute difference 27.1 (1.0) seconds.

JJM state that “FTP and PDS time stamps are almost identical, featuring differences of no more than a few seconds” (page 8). However, JM provide evidence that these differences are often economically large (at least by HFT standards). In particular, their Tables 1 and 2 report mean FTP gaps that are 7.6 (8.2) seconds larger than the mean PDS gaps for all (Form 4) filings. As noted in the introduction, “a few seconds” is a long time in the HFT world.

JJM note that “utilizing the FTP server to detect unexpected filings is technically difficult” (page 9).
**Table A1: Seconds between FTP time and various other times**

This table shows time differences, in seconds between the FTP time and four alternative times: SEC acceptance, first dissemination, first PDS, and SEC post. Panel A provides signed differences and Panel B provides absolute differences. In Panel A, positive differences indicate the FTP time is later. The differences are shown for the 4,669 observations with FTP date equal to SEC accept date. *** indicates p-value < 0.01 based on a paired t-test for means and a Wilcoxon matched-pair sign-rank test for medians.

<table>
<thead>
<tr>
<th>% FTP 1st</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: Difference between FTP time and:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEC Accept</td>
<td>22.0%</td>
<td>-3.7</td>
<td>-37.8***</td>
<td>-71.0</td>
<td>-62.3***</td>
</tr>
<tr>
<td>First Dissemination</td>
<td>36.5%</td>
<td>1.1</td>
<td>-4.3***</td>
<td>-13.8</td>
<td>-31.4***</td>
</tr>
<tr>
<td>First PDS</td>
<td>45.7%</td>
<td>10.8</td>
<td>-1.8***</td>
<td>-13.5</td>
<td>-24.8***</td>
</tr>
<tr>
<td>SEC Post</td>
<td>73.7%</td>
<td>2.8</td>
<td>1.1***</td>
<td>-0.5</td>
<td>-17.0***</td>
</tr>
<tr>
<td><strong>Panel B: Absolute difference between FTP time and:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEC Accept</td>
<td>17.3</td>
<td>38.8***</td>
<td>71.0</td>
<td>69.8***</td>
<td>470</td>
</tr>
<tr>
<td>First Dissemination</td>
<td>1.6</td>
<td>7.1***</td>
<td>15.2</td>
<td>34.8***</td>
<td>469</td>
</tr>
<tr>
<td>First PDS</td>
<td>5.9</td>
<td>12.2***</td>
<td>20.8</td>
<td>40.1***</td>
<td>469</td>
</tr>
<tr>
<td>SEC Post</td>
<td>1.0</td>
<td>1.8***</td>
<td>6.9</td>
<td>27.1***</td>
<td>453</td>
</tr>
</tbody>
</table>

As additional evidence related to the claim by JMM that the “FTP and PDS time stamps are almost identical,” we also note that the gap between the FTP and SEC post time and the gap between the first PDS post time and SEC post have a small but significantly positive correlation of 0.12.

**Reconciliation to concurrent studies**

JM find that the FTP time was an average (median) of 63 (5) seconds before the SEC posting for Form 4 filings (Table 1) and JJM find that the FTP time was an average (median) of 233 (24) seconds before the SEC posting for Form 4 filings (Table 1). Our gaps are substantially smaller. It is possible that these FTP gaps vary through time as evidenced by JM and JJM finding very different gaps when using somewhat different (yet overlapping) sample periods.

It is worth noting that the FTP times are scraped from the FTP system and are static over time unless there is an update or amendment for a particular file. In contrast, the SEC posting time can only be obtained when the posting occurs (i.e., it cannot be retroactively obtained). The accuracy of the posting time can be affected by the speed of the computer, the speed of connection, and the efficiency of the program that scrapes the SEC site in real-time. If any of these frictions are substantial, then the recorded SEC post time will be overstated (i.e., late). We take comfort in the accuracy of our SEC post times for three reasons. First, our source of the information is a PDS subscriber whose business model is based on obtaining the filings as quickly as possible (they reference their SEC post times as their third feed, in addition to the two PDS feeds, in conversation). Second, when our SEC post time is the first of our three dissemination sources (i.e., it is equal to first dissemination), we see the market reaction spike at the time of the SEC posting (refer to Figure 3 – both the price and volume reactions for the subsample where the SEC post is first spike at the second of our SEC posting). Third, the SEC has never refuted our findings and it has agreed to remedy the issue that we identified.
FTP Files as a source of high-frequency (low latency) trading

Finally, we examine whether there is evidence to suggest the FTP is actually used by traders. To examine this question, we plot how the market reacts depending on the direction and magnitude of the FTP time versus our proxy for first dissemination time. Before plotting the time differences, we first show the distribution of these differences in Table A2. FTP is within one second of first dissemination time for only 13% of the observations, is more than one second slower (faster) for 61% (26%) of the observations.

Table A2: Differences between FTP and first dissemination times

This table shows the distribution of timing delays, in seconds, between the FTP time and the first dissemination (i.e., the earlier of the first PDS feed and the SEC post). Positive differences indicate the FTP arrived first and negative differences indicate the first dissemination was first.

<table>
<thead>
<tr>
<th>Seconds between FTP and first dissemination</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>% FTP &gt; 1 second before</td>
<td>26%</td>
</tr>
<tr>
<td>% FTP within 1 second</td>
<td>13%</td>
</tr>
<tr>
<td>% FTP &gt; 1 second after</td>
<td>61%</td>
</tr>
<tr>
<td>[0, 1) FTP before first dissemination</td>
<td>10%</td>
</tr>
<tr>
<td>[-1, 0) FTP after first dissemination</td>
<td>3%</td>
</tr>
<tr>
<td>[-2, -1)</td>
<td>3%</td>
</tr>
<tr>
<td>[-3, -2)</td>
<td>3%</td>
</tr>
<tr>
<td>[-4, -3)</td>
<td>3%</td>
</tr>
<tr>
<td>[-5, -4)</td>
<td>3%</td>
</tr>
<tr>
<td>[-15, -6)</td>
<td>26%</td>
</tr>
<tr>
<td>[-25, -16)</td>
<td>15%</td>
</tr>
<tr>
<td>[-35, -26)</td>
<td>4%</td>
</tr>
<tr>
<td><strong>less</strong></td>
<td>3%</td>
</tr>
</tbody>
</table>

# obs 4,669

In Figure A1 below, we divide the sample into three groups based on the magnitude of the (absolute) difference between the FTP and first dissemination times. In the first group, the FTP time and first dissemination time are approximately the same, defined as within one second (“within 1 sec”). In the second group, the times are 1-10 seconds apart (“1-10 sec diff”), and in the third group the times are more than 10 seconds apart (“>10 sec diff”). The price reactions are plotted using FTP time (i.e., t=0 is the FTP
Our expectation is that, if the FTP time is accurate and the FTP system is used for trading, we should see a spike at $t=0$ for all groups suggesting trading occurs when the information becomes available. However, if it is the first dissemination time that is accurate and traded on then we should only see a spike at $t=0$ for the observations where FTP is approximately equal to first dissemination (i.e., “within 1 sec”). It is apparent from the lines in Figure D1 that only the observations where the FTP time approximates first dissemination show a spike around $t=0$.

**Figure A1: Returns around FTP timestamp**

This plot shows the returns around the FTP time for three subsets of filings: 1. Filings that have an FTP time within one second of first dissemination (“within 1 sec”); 2. Filings that have an FTP time between 1-10 seconds of the first dissemination time (“1-10 sec diff”); and 3. Filings that have an FTP time more than 10 seconds different from the first dissemination time (“>10 sec diff”).

In Figure A2 below, we divide the group with the greatest difference between FTP and first dissemination times (i.e., the “>10 sec” group from Figure D1) into those observations where the FTP is earlier versus later than the first dissemination time. Our expectation is that, if the market reaction occurs at our measure of first dissemination and not FTP time, the markets will move before the FTP time ($t=0$) when the FTP occurs later (“>10 sec late”) and will move after the FTP time when the FTP occurs earlier (“>10 sec early”). These expectations are borne out by the data as we see the market reacting more than 10 seconds after (before) the FTP time for the early (late) group.
Figure A2: Returns around FTP timestamp given large FTP-First Dissemination time differences
This plot shows the returns around the FTP time for filings with FTP time more than 10 seconds difference from the first dissemination time, split into those where the FTP is early (“>10 sec early”) and those where the FTP is late (“>10 sec late”).

In summary, the evidence is consistent with our measure of first dissemination time being the more likely source of trading information and the FTP system being in limited use (if in use at all) by traders. Based on these results, we do not incorporate the FTP timestamp into our main analysis.
Appendix B: Variable Definitions

Independent Variables (Tables)
Note: all continuous variables winsorized at 1% and 99%.

Trade Size = The dollar value of the insider purchase, from T-R.
Firm Size = Total assets, from Compustat, in millions.
Filing Cluster = The number of filings posted to EDGAR in the 60 seconds prior to the Form 4 posting.
Prior Trading = The total amount of purchase activity, in dollars, that the insider engaged in during the prior 365 days, from T-R.
CEO = 1 if the insider is the CEO, 0 otherwise.
CFO = 1 if the insider is the CFO, 0 otherwise.
DJ Coverage = 1 if the firm has Form 4 filings covered by Dow Jones (per the RavenPack archive), 0 otherwise.
Time Trend = a measure of chronological time, equal to 1 for observations in the first month of the data and 22 for those in the last month.

Market Reaction Variables (Figures)

Returns = The percent change in price between event time and the price 60 seconds prior to dissemination.
% Abnormal Volume = Cumulative dollar volume from t = -60 to through event second t minus the average of the same for the exact same window (calculated over the prior 52 weeks), deflated by the average cumulative volume for the entire 120 second window (again calculated over the prior 52 weeks).
% Abnormal Spreads = The percent of normal spread, measured as (spread at time t) / (spread at 60 seconds prior to dissemination).
Table 1: Sample construction

Table describes sample construction. We begin with all insider filings available from Thomson-Reuters (T-R) from March 1, 2012 through December 31, 2013 (Line 1) and merge with Form 4 time stamps from EDGAR, which yields the sample in Line 2. We eliminate multiple filings for a given firm within a five minute window (Line 3) and then restrict the sample to filings posted to the SEC website between 9:40am and 3:30pm on trading days (Line 4). We merge this sample with TAQ trading data (Line 5). To minimize data errors we require that the last transaction price falls within the CRSP daily trading range (Line 6).

<table>
<thead>
<tr>
<th>Line</th>
<th>Total Trades</th>
<th>Purchases</th>
<th>Sales</th>
<th>% Purchases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 1: Starting sample from T-R (stock not options, Form 4, Mar. 1, 2012 - Dec. 31, 2013, including Officers, Directors and Committee members)</td>
<td>97,398</td>
<td>23,128</td>
<td>74,270</td>
<td>23.7%</td>
</tr>
<tr>
<td>Line 2: Match company CIK and insider name to SEC filings on EDGAR</td>
<td>88,841</td>
<td>19,327</td>
<td>69,514</td>
<td>21.7%</td>
</tr>
<tr>
<td>Line 3: Restrict to “isolated” Form 4 filings (exclude multiple filings within 5 minutes of each other)</td>
<td>66,110</td>
<td>15,257</td>
<td>50,853</td>
<td>23.1%</td>
</tr>
<tr>
<td>Line 4: Posted to SEC website 9:40am to 3:30pm EST</td>
<td>21,004</td>
<td>6,727</td>
<td>14,277</td>
<td>32.0%</td>
</tr>
<tr>
<td>Line 5: With TAQ data</td>
<td>18,721</td>
<td>5,289</td>
<td>13,432</td>
<td>28.3%</td>
</tr>
<tr>
<td>Line 6: Insider's last transaction price within daily trading range on CRSP</td>
<td>17,960</td>
<td>4,782</td>
<td>13,178</td>
<td>26.6%</td>
</tr>
</tbody>
</table>
Table 2: Descriptive Statistics

Table reports descriptive statistics for trade and firm characteristics for insider purchase transactions. Variables are defined in Appendix B. P-values are from tests of differences in means (medians) between samples from a two-sided t-test (Wilcoxon rank-sums test). For binary variables, significance is based on p-values from a chi-squared test.

<table>
<thead>
<tr>
<th></th>
<th>Line 3 Sample</th>
<th>Line 6 sample (restrict to within trade hours)</th>
<th>Test of Diff. (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td><strong>Trade Size ($)</strong></td>
<td>15,257</td>
<td>189,519</td>
<td>17,949</td>
</tr>
<tr>
<td><strong>Firm Size ($m)</strong></td>
<td>14,430</td>
<td>3,404</td>
<td>543</td>
</tr>
<tr>
<td><strong>Filing Cluster</strong></td>
<td>15,257</td>
<td>4.75</td>
<td>3.00</td>
</tr>
<tr>
<td><strong>Prior Trade ($)</strong></td>
<td>15,257</td>
<td>510,606</td>
<td>38,000</td>
</tr>
<tr>
<td><strong>CEO</strong></td>
<td>15,257</td>
<td>0.18</td>
<td>0</td>
</tr>
<tr>
<td><strong>CFO</strong></td>
<td>15,257</td>
<td>0.06</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 3: Timing differences between EDGAR posting and earliest of the two PDS subscriber feeds

Table shows the delay, in seconds, between the first PDS feed and EDGAR post for the Table 1, Line 6 sample. Negative (positive) differences indicate that PDS feed occurs before (after) SEC post.

<table>
<thead>
<tr>
<th>Seconds different</th>
<th>Purchases</th>
<th>Percent</th>
<th>Cum. Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>More</td>
<td>1.40%</td>
<td>1.40%</td>
<td></td>
</tr>
<tr>
<td>-89 to -85</td>
<td>0.13%</td>
<td>1.53%</td>
<td></td>
</tr>
<tr>
<td>-84 to -80</td>
<td>0.08%</td>
<td>1.61%</td>
<td></td>
</tr>
<tr>
<td>-79 to -75</td>
<td>0.10%</td>
<td>1.71%</td>
<td></td>
</tr>
<tr>
<td>-74 to -70</td>
<td>0.08%</td>
<td>1.80%</td>
<td></td>
</tr>
<tr>
<td>-69 to -65</td>
<td>0.02%</td>
<td>1.82%</td>
<td></td>
</tr>
<tr>
<td>-64 to -60</td>
<td>0.04%</td>
<td>1.86%</td>
<td></td>
</tr>
<tr>
<td>-59 to -55</td>
<td>0.15%</td>
<td>2.01%</td>
<td></td>
</tr>
<tr>
<td>-54 to -50</td>
<td>0.17%</td>
<td>2.17%</td>
<td></td>
</tr>
<tr>
<td>-49 to -45</td>
<td>0.21%</td>
<td>2.38%</td>
<td></td>
</tr>
<tr>
<td>-44 to -40</td>
<td>0.17%</td>
<td>2.55%</td>
<td></td>
</tr>
<tr>
<td>-39 to -35</td>
<td>0.33%</td>
<td>2.89%</td>
<td></td>
</tr>
<tr>
<td>-34 to -30</td>
<td>1.25%</td>
<td>4.14%</td>
<td></td>
</tr>
<tr>
<td>-29 to -25</td>
<td>3.53%</td>
<td>7.67%</td>
<td></td>
</tr>
<tr>
<td>-24 to -20</td>
<td>7.36%</td>
<td>15.04%</td>
<td></td>
</tr>
<tr>
<td>-19 to -15</td>
<td>9.39%</td>
<td>24.42%</td>
<td></td>
</tr>
<tr>
<td>-14 to -10</td>
<td>10.16%</td>
<td>34.59%</td>
<td></td>
</tr>
<tr>
<td>-9 to -5</td>
<td>10.98%</td>
<td>45.57%</td>
<td></td>
</tr>
<tr>
<td>-4 to 0 (PDS 1st)</td>
<td>11.54%</td>
<td>57.11%</td>
<td></td>
</tr>
<tr>
<td>1 to 5 (SEC 1st)</td>
<td>11.04%</td>
<td>68.15%</td>
<td></td>
</tr>
<tr>
<td>6 to 10</td>
<td>9.41%</td>
<td>77.56%</td>
<td></td>
</tr>
<tr>
<td>11 to 15</td>
<td>7.36%</td>
<td>84.92%</td>
<td></td>
</tr>
<tr>
<td>16 to 20</td>
<td>4.45%</td>
<td>89.38%</td>
<td></td>
</tr>
<tr>
<td>21 to 25</td>
<td>3.16%</td>
<td>92.53%</td>
<td></td>
</tr>
<tr>
<td>26 to 30</td>
<td>2.24%</td>
<td>94.77%</td>
<td></td>
</tr>
<tr>
<td>31 to 35</td>
<td>1.38%</td>
<td>96.15%</td>
<td></td>
</tr>
<tr>
<td>36 to 40</td>
<td>0.79%</td>
<td>96.95%</td>
<td></td>
</tr>
<tr>
<td>41 to 45</td>
<td>0.88%</td>
<td>97.83%</td>
<td></td>
</tr>
<tr>
<td>46 to 50</td>
<td>0.48%</td>
<td>98.31%</td>
<td></td>
</tr>
<tr>
<td>51 to 55</td>
<td>0.38%</td>
<td>98.68%</td>
<td></td>
</tr>
<tr>
<td>56 to 60</td>
<td>0.19%</td>
<td>98.87%</td>
<td></td>
</tr>
<tr>
<td>61 to 65</td>
<td>0.38%</td>
<td>99.25%</td>
<td></td>
</tr>
<tr>
<td>66 to 70</td>
<td>0.15%</td>
<td>99.39%</td>
<td></td>
</tr>
<tr>
<td>71 to 75</td>
<td>0.13%</td>
<td>99.52%</td>
<td></td>
</tr>
<tr>
<td>76 to 80</td>
<td>0.06%</td>
<td>99.58%</td>
<td></td>
</tr>
<tr>
<td>81 to 85</td>
<td>0.08%</td>
<td>99.67%</td>
<td></td>
</tr>
<tr>
<td>86 to 90</td>
<td>0.04%</td>
<td>99.71%</td>
<td></td>
</tr>
<tr>
<td>More</td>
<td>0.29%</td>
<td>100.00%</td>
<td></td>
</tr>
</tbody>
</table>

# zeros 3
# obs 4,782
Table 4: Determinants of reporting delays
Table provides descriptive statistics and regression analysis of reporting delays for insider purchase filings. Panel A presents the distributions of reporting delays. Panel B provides univariate comparisons for trade and firm variables based on whether the PDS feeds arrive before the SEC posting (PDS 1st) or after (SEC 1st). Columns 1, 2, and 3 of Panel C examine the delay between the SEC’s acceptance of the document and SEC posting, PDS feed #1, and PDS feed #2, respectively. Column 4 examines the time delay between first dissemination (i.e., when the PDS subscriber first receives the information, equal to the earliest of the PDS feeds and the SEC posting) and SEC posting. All variables are defined in Appendix B. P-values for tests of differences in means are for a two-sided t-test. P-values for tests of differences in medians are for a two-sided Wilcoxon rank-sum test. For binary variables, significance is based on p-values for chi-squared tests. Regression standard errors are clustered at the year-month level.

### Panel A: Reporting delays

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptance to SEC post</td>
<td>4,782</td>
<td>31.4</td>
<td>36.2</td>
<td>41.6</td>
<td>40.2</td>
<td>23.9</td>
</tr>
<tr>
<td>Acceptance to first dissemination</td>
<td>4,782</td>
<td>22.2</td>
<td>30.2</td>
<td>36.4</td>
<td>29.7</td>
<td>10.4</td>
</tr>
<tr>
<td>1st dissemination to SEC post (private advantage)-All</td>
<td>4,782</td>
<td>0</td>
<td>3.2</td>
<td>14.9</td>
<td>10.5</td>
<td>22.5</td>
</tr>
<tr>
<td>1st dissemination to SEC post (private advantage)-PDS 1st</td>
<td>2,728</td>
<td>6.3</td>
<td>13.0</td>
<td>20.4</td>
<td>18.2</td>
<td>27.3</td>
</tr>
</tbody>
</table>

### Panel B: Univariate Descriptives

<table>
<thead>
<tr>
<th></th>
<th>PDS 1st</th>
<th>SEC 1st</th>
<th>Test of Diff (p-val.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>Trade Size ($)</td>
<td>2,728</td>
<td>63,061</td>
<td>16,480</td>
</tr>
<tr>
<td>Firm size ($m)</td>
<td>2,556</td>
<td>3,223</td>
<td>668</td>
</tr>
<tr>
<td>Filing Cluster</td>
<td>2,728</td>
<td>2.3</td>
<td>2.0</td>
</tr>
<tr>
<td>Prior Trade ($)</td>
<td>2,728</td>
<td>163,332</td>
<td>35,442</td>
</tr>
<tr>
<td>DJ Coverage</td>
<td>2,728</td>
<td>0.79</td>
<td>1</td>
</tr>
<tr>
<td>CEO</td>
<td>2,728</td>
<td>0.17</td>
<td>0</td>
</tr>
<tr>
<td>CFO</td>
<td>2,728</td>
<td>0.06</td>
<td>0</td>
</tr>
</tbody>
</table>

### Panel C: OLS regressions examining timing differences

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Acceptance to SEC post</th>
<th>Acceptance to PDS feed #1</th>
<th>Acceptance to PDS feed #2</th>
<th>1st Dissemination to SEC post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coeff</td>
<td>t-stat</td>
<td>Coeff</td>
<td>t-stat</td>
</tr>
<tr>
<td>Intercept</td>
<td>25.270***</td>
<td>3.87</td>
<td>27.318***</td>
<td>4.75</td>
</tr>
<tr>
<td>Lag(1+Trade Size)</td>
<td>0.195</td>
<td>0.60</td>
<td>0.530</td>
<td>1.54</td>
</tr>
<tr>
<td>Lag(1+Firm Size)</td>
<td>0.309</td>
<td>1.27</td>
<td>0.025</td>
<td>0.24</td>
</tr>
<tr>
<td>Lag(1+Filing Cluster)</td>
<td>5.054***</td>
<td>3.82</td>
<td>14.399***</td>
<td>17.86</td>
</tr>
<tr>
<td>Lag(1+Prior Trading)</td>
<td>-0.114</td>
<td>-0.30</td>
<td>-0.445</td>
<td>-1.34</td>
</tr>
<tr>
<td>DJ Coverage</td>
<td>-0.044</td>
<td>-0.05</td>
<td>-0.431</td>
<td>-0.61</td>
</tr>
<tr>
<td>CEO</td>
<td>0.288</td>
<td>0.37</td>
<td>0.047</td>
<td>0.09</td>
</tr>
<tr>
<td>CFO</td>
<td>0.281</td>
<td>0.19</td>
<td>0.308</td>
<td>0.32</td>
</tr>
<tr>
<td>Lag(1 + Time Trend)</td>
<td>2.657</td>
<td>1.64</td>
<td>-3.508</td>
<td>-1.40</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.024</td>
<td>0.260</td>
<td>0.260</td>
<td>0.260</td>
</tr>
<tr>
<td>N</td>
<td>4,473</td>
<td>4,473</td>
<td>4,472</td>
<td>4,473</td>
</tr>
</tbody>
</table>
Table 5: Returns to insider purchases

This table shows insider trade characteristics and returns to four samples of insider purchase filings based on the sample in Line 6 of Table 1. The four samples include purchases where 1) the SEC post was before the first PDS feed (SEC 1st); 2) the first PDS feed was before the SEC post (PDS 1st); 3) within the PDS 1st sample there was at least one trade based on the PDS information and at least one trade based on public information (PDS 1st – Trade); and 4) within the PDS 1st sample but missing one or both of the required trades (PDS 1st – No trade). For the PDS 1st – Trade sample, we provide the private advantage returns, defined as the returns accumulating between the first trade in the PDS window and the first trade after the SEC post (Returns: Private Advantage). For all four samples, we also provide the returns between the insider trade and the SEC acceptance of the Form 4 filing (Returns: Insider trade to SEC Accept), the returns between SEC Accept and the end of the trading day (Returns: SEC Accept to End of Day), the returns between SEC Accept and 10 days later (Returns: SEC Accept to 10 day), the size of the insider’s trade, in dollars (Insider Trade Size), and the percent of routine trades using a measure based on Cohen, Malloy, and Pomorski (2012) (% Routine Trades). P-values for means are estimated using t-tests and p-values of medians are estimated using Wilcoxon rank-sum tests.

<table>
<thead>
<tr>
<th></th>
<th>SEC 1st Mean (Median)</th>
<th>PDS 1st Mean (Median)</th>
<th>P-value</th>
<th>PDS 1st Trade Mean (Median)</th>
<th>PDS 1st No Trade Mean (Median)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td># Observations</td>
<td>2,054</td>
<td>2,728</td>
<td></td>
<td>1,065</td>
<td>1,663</td>
<td></td>
</tr>
<tr>
<td>Returns</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Advantage</td>
<td>0.28% (0.13%)</td>
<td></td>
<td>0.29% (0.13%)</td>
<td>0.30% (0.00%)</td>
<td>0.95 (0.32)</td>
<td></td>
</tr>
<tr>
<td>Insider trade to</td>
<td>0.57% (0.06%)</td>
<td>0.30% (0.05%)</td>
<td>0.10 (0.74)</td>
<td>0.29% (0.13%)</td>
<td>0.30% (0.00%)</td>
<td>0.95 (0.32)</td>
</tr>
<tr>
<td>SEC Accept</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEC Accept to</td>
<td>0.62% (0.35%)</td>
<td>0.57% (0.34%)</td>
<td>0.55 (0.55)</td>
<td>1.01% (0.58%)</td>
<td>0.30% (0.18%)</td>
<td>&lt;0.01 (0.01)</td>
</tr>
<tr>
<td>End of Day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEC Accept to</td>
<td>2.36% (1.33%)</td>
<td>2.65% (1.23%)</td>
<td>0.58 (0.32)</td>
<td>2.61% (1.79%)</td>
<td>2.68% (0.96%)</td>
<td>0.94 (&lt;0.01)</td>
</tr>
<tr>
<td>10 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insider Trade Size</td>
<td>151,475 (17,250)</td>
<td>105,413 (16,480)</td>
<td>0.21 (0.19)</td>
<td>214,400 (50,000)</td>
<td>35,617 (9,000)</td>
<td>&lt;0.01 (&lt;0.01)</td>
</tr>
<tr>
<td>% Routine Trades</td>
<td>8.4%</td>
<td>9.4%</td>
<td>0.20</td>
<td>5.37%</td>
<td>12.01%</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>
Table 6: Returns to insider purchase split on firm size

This table is similar to Table 6 for the subsamples of large and small firms. The firms in Table 6 are divided into large and small firms based on the median firm size (market value of equity). Panel A shows the returns for large firms and Panel B shows the returns for small firms. The four samples in each panel include purchases where 1) the SEC post was before the first PDS feed \((SEC\ 1^{st})\); 2) the first PDS feed was before the SEC post \((PDS\ 1^{st})\); 3) within the \(PDS\ 1^{st}\) sample there was at least one trade based on the PDS information and at least one trade based on public information \((PDS\ 1^{st} – \text{Trade})\); and 4) within the \(PDS\ 1^{st}\) sample but missing one or both of the required trades \((PDS\ 1^{st} – \text{No trade})\). For the \(PDS\ 1^{st} – \text{Trade}\) sample, we provide the private advantage returns, defined as the returns accumulating between the first trade in the PDS window and the first trade after the SEC post (Returns: Private Advantage). For all four samples, we also provide the returns between the insider trade and the SEC acceptance of the Form 4 filing (Returns: Insider trade to SEC Accept), the returns between SEC Accept and the end of the trading day (Returns: SEC Accept to End of Day), the returns between SEC Accept and 10 days later (Returns: SEC Accept to 10 day), the size of the insider’s trade, in dollars (Insider Trade Size), and the percent of routine trades using a measure based on Cohen, Malloy, and Pomorski (2012) (% Routine Trades). P-values for means are estimated using t-tests and p-values of medians are estimated using Wilcoxon rank-sum tests.

### Panel A: Returns to insider purchases – Large Firms

<table>
<thead>
<tr>
<th></th>
<th>SEC 1st Mean (Median)</th>
<th>PDS 1st Mean (Median)</th>
<th>P-value Mean (Median)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td># Observations</td>
<td>1,014 (1,377)</td>
<td>893 (484)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Returns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Advantage</td>
<td>0.26% (0.12%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insider trade to SEC Accept</td>
<td>0.46% (0.07%)</td>
<td>0.40% (0.17%)</td>
<td>0.72 (0.34)</td>
<td>0.38% (0.16%)</td>
</tr>
<tr>
<td>SEC Accept to End of Day</td>
<td>0.70% (0.39%)</td>
<td>0.60% (0.37%)</td>
<td>0.10 (0.30)</td>
<td>0.81% (0.49%)</td>
</tr>
<tr>
<td>SEC Accept to 10 days</td>
<td>1.19% (1.06%)</td>
<td>1.22% (1.01%)</td>
<td>0.90 (0.85)</td>
<td>1.43% (1.05%)</td>
</tr>
<tr>
<td>Insider Trade Size</td>
<td>275,030 (35,651)</td>
<td>181,159 (32,948)</td>
<td>0.20 (0.09)</td>
<td>241,888 (52,888)</td>
</tr>
<tr>
<td>% Routine Trades</td>
<td>7.52% (9.92%)</td>
<td>0.04</td>
<td></td>
<td>6.30% (16.60%)</td>
</tr>
</tbody>
</table>
### Panel B: Returns to insider purchases – Small Firms

<table>
<thead>
<tr>
<th></th>
<th>SEC 1st Mean (Median)</th>
<th>PDS 1st Mean (Median)</th>
<th>P-value Mean (Median)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td># Observations</td>
<td>1,040 (Median)</td>
<td>1,351 (Median)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Private Advantage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insider trade to SEC Accept</td>
<td>0.38% (-0.04%)</td>
<td>0.19% (-0.13%)</td>
<td>0.09 (-0.16%)</td>
<td>0.09 (0.16)</td>
</tr>
<tr>
<td>SEC Accept to End of Day</td>
<td>0.53% (0.29%)</td>
<td>0.55% (0.29%)</td>
<td>0.87 (0.90)</td>
<td>0.87 (0.90)</td>
</tr>
<tr>
<td>SEC Accept to 10 days</td>
<td>2.26% (0.83%)</td>
<td>2.90% (0.82%)</td>
<td>0.51 (0.36)</td>
<td>0.51 (0.36)</td>
</tr>
<tr>
<td>Insider Trade Size</td>
<td>31,009 (9,498)</td>
<td>28,209 (9,627)</td>
<td>0.51 (0.68)</td>
<td>0.51 (0.68)</td>
</tr>
<tr>
<td>% Routine Trades</td>
<td>9.18% (8.91%)</td>
<td>8.91% (8.91%)</td>
<td>0.82 (0.82)</td>
<td>0.82 (0.82)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>PDS 1st Trade Mean (Median)</th>
<th>PDS 1st No Trade Mean (Median)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>172 (Median)</td>
<td>1,179 (Median)</td>
<td></td>
</tr>
</tbody>
</table>

Returns:

- **Private Advantage**:
  - Insider trade to SEC Accept: 0.38% (0.04%), P-value = 0.09 (0.16)
  - SEC Accept to End of Day: 0.53% (0.29%), P-value = 0.87 (0.90)
  - SEC Accept to 10 days: 2.26% (0.83%), P-value = 0.51 (0.36)
  - Insider Trade Size: 31,009 (9,498), P-value = 0.51 (0.68)
  - % Routine Trades: 9.18% (8.91%), P-value = 0.82 (0.82)
Figure 1: The EDGAR Dissemination Process

EDGAR
1. Parses Doc
2. Runs checks/rules
3. Accepts
4. Re-Assembles

Filer submits document

PDS Server

PDS Site

PDS Subscribers

Clients

Publicly Available on SEC site

* According to SEC documentation, these will occur simultaneously

** Can be before or after filing available to PDS subscribers and/or clients
Figure 2: Distribution of time differences between the two PDS feeds

The figure below plots the distribution of timing differences (in seconds, winsorized at 1% and 99%) between the two PDS feeds. The sample included in the plot are all Form 4 insider trade filings between March 1, 2012-December 31, 2013 that are unique to a firm within a five minute window and that we can match to the SEC filing on EDGAR (i.e., Line 3 from Table 1).
Figure 3: Market reactions in “SEC Time” based on whether the PDS feeds arrive before or after the SEC posting

The figures below plot percent returns (Panel A), percent abnormal volume (Panel B), and percent abnormal spreads (Panel C) for a two minute window around the EDGAR posting. In each panel, the Table 1, Line 6 sample for insider purchases is divided into those observations where the PDS feed arrives first (i.e., 2,728 observations where the PDS subscriber has a private advantage; PDS 1st) and those for which the SEC posting occurs first (i.e., 2,054 observations where the PDS subscriber receives the SEC feed as their first source; SEC 1st). Panel D provides details on the t-statistics of tests of differences between the two samples for the plots in Panels A-C. Market reaction variables are defined in Appendix B.

Panel A: Returns for insider purchases

Panel B: Percent abnormal volume for insider purchases
Panel C: Percent abnormal spreads for insider purchases

- Spread as a % of the spread 60 second prior to SEC post
- Seconds after SEC Posting

Panel D: Distribution of t-statistics testing SEC 1st versus PDS 1st timing from Panels A-C

- T-Statistic
- Seconds after SEC Posting
Figure 4: Market reactions of the full sample in “First Dissemination Time” and “Public Time”

The figures below plot percent returns (Panel A), percent abnormal volume (Panel B), and percent abnormal spreads (Panel C) for a two minute window around either the SEC EDGAR posting (Public Time) or the first time the PDS subscriber receives the filing (1st Dissemination time). In each panel, the sample equals the insider purchases from Table 1, Line 6. The solid line represents the distribution of the respective market measure centered around the first time the filing is received by the PDS subscriber, equal to first of the two PDS feeds and the EDGAR posting (i.e., t=0 is the time the PDS subscriber first received the information). The dotted line represents the distribution of the respective market measure centered around the public EDGAR posting (i.e., t=0 is the time the filing appeared on the EDGAR website). Market reaction variables are defined in Appendix B.

Panel A: Returns for insider purchases

![Returns graph]

Panel B: Percent abnormal volume for insider purchases

![Abnormal Volume graph]
Figure 5: Relation between timing advantage and return advantage

The figure below show the average return advantage across 100 quantiles of the delay (difference between the first PDS feed and the SEC post time). Quantile 1 is the quantile containing the lowest return advantages and quantile 100 contains the highest. The return advantage is the Private Advantage returns as calculated in Table 5 for the PDS 1st Trade sample (1,065 observations where the PDS feed is before the SEC posting and there is at least one trade during the private window).
Figure 6: Market reactions, split on firm size, in “SEC Time” based on whether the PDS feeds arrive before or after the SEC posting

The figures below are similar to Figure 3 with the sample split at the median of firm size (market value of equity). The plots show percent returns (Panel A), percent abnormal volume (Panel B), and raw volume (Panel C) for a two minute window around the EDGAR posting. In each panel, the Table 1, Line 6 sample is divided into those observations where the PDS feed arrives first (PDS 1st) and those for which the SEC posting occurs first (SEC 1st). Market reaction variables are defined in Appendix B.

Panel A: Returns for insider purchases

Panel B: Percent abnormal volume for insider purchases
Panel C: Raw volume for insider purchases

VOLUME - Large vs. Small Firms (MVE)

Raw Dollar Volume

Seconds after SEC Posting

- PDS 1st-large
- SEC 1st-large
- PDS 1st-small
- SEC 1st-small