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Timing Complex News to Target Attention

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ABSTRACT

Investors have limited and time-varying attention. These constraints are heterogeneous across investors, which can create asymmetric information and adverse selection problems. We show how firms take these constraints into account: they release harder-to-process news in periods when investor attention is higher. We use an institutional discontinuity within the U.S. corporate filing system to measure these effects. Filings before 5:30 pm become available immediately, while filings after 5:30 pm only become visible the next morning and attract less attention. Firms release longer and more complex news just before the cutoff, giving investors the longest possible period to absorb the information before markets open. Firm experience faster price convergence and more liquidity after pre-cutoff news despite their complexity, which is consistent with the additional attention that they attract. We outline a framework in which the need for investors to spread their attention across different ideas induces firms to file their more complex filings at times when investor attention is higher. Our results are consistent with an equilibrium in which investors pay more attention to complex news and in which firms with complex news time them to target investor attention.

JEL codes: D83, G14

Keywords: investor attention, strategic timing, news

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1. Introduction

This paper uses the timing of complex news to study how firms cater to investor attention. Growing empirical evidence suggests that investor attention is limited and time-varying (e.g., Gargano and Rossi, 2018; Peress and Schmidt, 2018; Fedyk, 2020). Not all investors always have enough capacity to process new information. News releases at times of low attention can thus increase information asymmetry and ultimately depress liquidity and stock prices (Pagano and Röell, 1996; Amihud, 2002; Shapiro, 2002; Biais, Foucault, and Moinas, 2015; Di Maggio and Pagano, 2018). More generally, the slow processing of complex information can damage prices by creating idiosyncratic risk from the perspective of investors (Klein and Bawa, 1976; Barry and Brown, 1985; Coles and Loewenstein, 1988; Zhang, 2006). Asymmetric information is therefore central to the theory of financial markets, yet there is little evidence that firms actively facilitate the processing of complex news.

This paper provides empirical evidence of such "attention targeting" by firms. Specifically, we ask whether firms time the release of harder-to-process news to target investor attention. Our context is the intraday timing of current event filings (8-K) in the U.S. These filings cover the universe of unexpected material events, which public firms must file within four business days after occurrence (Niessner, 2015; Callen, Kaniel, and Segal, 2019). We show that firms use the flexibility within that time to release harder-to-process news when information processing ability is most symmetric across investors. While our results may apply to a broader set of news, we focus on 8-K filings as they contain all the unscheduled and unexpected events.

To illustrate the economic forces behind our empirical results, we present a simple analytical framework of the filing strategy of firms and the attention strategy of investors. The cost of attention depends on the timing of the filing, so investors allocate more attention when the cost is lower. Investors also care about assigning enough attention to each idea within the filings. More complex filings contain more ideas, so investors devote more attention to these. Firms maximize attention to filings. From their perspective, the investors' strategy creates a complementarity between complexity and filing when the cost of attention is lower. In equilibrium, firms target complex news to become public at times with more investor attention as part of a filing strategy that includes other motives. The firm and investor strategies reinforce each other, so, in equilibrium, they appear to coordinate.

We then use two distinct attention regimes in the data to show that firms and investor strategies are consistent with the equilibrium of our analytical framework. We exploit a sharp institutional discontinuity in the U.S. corporate filing system at 5:30 pm of each business day. While filings up to 5:30 pm are almost immediately available to investors, filings after 5:30 pm enter overnight storage and become visible at the same time on the next morning. The morning release leaves readers little time to process news before the markets open at 9:30 am. The processing for such "overnight" filings is additionally challenging because the morning release includes many filings at once (270 filings on an average day, of which 43 are 8-Ks). Therefore, paying attention to filings after 5:30 pm requires more effort by investors. Firms, on the contrary, are not directly affected by the 5:30 pm threshold, except for the expected change in investor attention. Importantly for our empirical strategy, other factors that could affect the supply of news evolve gradually and do not change abruptly around the 5:30 pm cutoff.[1] Moreover, the setting repeats every day, creating an environment where firms have information on expected investor attention at any given time and can adjust their disclosure policy accordingly.

The discrete discontinuity in attention between the two time periods is large: a filing just before the cutoff receives, on average, 19 more downloads (28% of one standard deviation) in its first 24 hours of visibility than a filing submitted just after the cutoff.

We focus on download counts, which have been used and identified in the previous literature a as a valid measure of attention. Download counts are significantly related to other attention measures like Bloomberg searches and reading activity (Ben-Rephael, Da, and Israelsen, 2017; Iliev, Kalodimos, and Lowry, 2021). Within each time period (pre- and post-5:30pm), investors devote more attention to more complex news. We also document that, more generally (i.e., outside the 5:30pm threshold), investors are quicker to download filings that become public separately.

We show that firms indeed file different types of proposal during the two distinct attention regimes. Firms file harder-to-process news pre-cutoff. Filings just before the cutoff are longer, concern a wider range of topics, and are harder to read than those filed just post-cutoff. Compared to filings released just post-cutoff, filings released just before the cutoff on average contain 1,006 more words (25% of one standard deviation) and are classified into 0.3 more categories (8-K "items", 31% of one standard deviation); their Fog readability score implies that the reader needs the equivalent of half a year more of schooling to fully

[1] The only obvious discrete change at the cutoff is the official filing date. This is irrelevant for most filings, except for those that were filed close to the filing deadline. We avoid this being a confounding factor by excluding all on-deadline or past-deadline filings from our sample.

understand their text (12% of one standard deviation). These results hold both within firms (i.e., a given firm choosing when to release different news) and between firms (i.e., inherently more complex firms being more prone to file before 5:30 pm). The concentration of complex news just before 5:30 pm and its sudden drop after 5:30 pm provide evidence that firms match news to expected investor attention.

Attention targeting matters. Firms succeed in gaining investor attention and accelerating price formation for pre-cutoff filings. Returns following pre-cutoff news converge faster to their long-run return than after otherwise similar post-cutoff news. As soon as the market opens following pre-cutoff filings, prices jump to a level close to the long-run (10-day) one. The difference in speed of convergence is more pronounced for harder-to-process news which, had they not been released during a high-attention period, would usually take longer to converge. Moreover, filings just after the cutoff attract more trading volume and exhibit lower spreads. These results are consistent with the idea that, when investors have heterogeneous abilities to process news, matching complex news with more attention can reduce information asymmetry.

Not only are 8-Ks convenient for the analysis of news timing, but they are also economically relevant. 8-K are the most numerous of all Security and Exchange Commission (SEC) filings after insider trading forms (Form 4). Within 8-K filings, the period around the 5:30 pm cutoff is the most relevant period for a large proportion of filings. Around the cutoff – between 4:30 pm and 6:00 am – firms in our sample made 163,094 8-K filings, accounting for 37% of the entire universe of 442,073 8-K filings. Within this period, firms made 70,709 filings between 5:00 pm and 5:30 pm and 39,065 after 5:30 pm, with a peak in density just before 5:30 pm. Nevertheless, we choose this period for its empirical convenience, and it is not necessarily representative of the whole population of filings. While our results may generalize to other time periods or contexts, we cannot strictly speaking extrapolate our results to these. We also document that firms time their filings for reasons other than attention management: we show evidence on the existence of some of these motives. In our theoretical model, these alternative motives are a necessary condition for firms filing early and late. However, these alternative motives do not explain by themselves the sharp empirical filing type discontinuity at 5:30 pm. This paper is the first to document the existence of the sharp discontinuity in investor attention around that hour and to study the consequences of the resulting informational blackout.

To summarize, the main results of the paper show evidence for the strategic timing of news releases to match more complex news with periods of higher investor attention. Firms release more complex news at times of higher expected attention with more time to process before the next market opening. Such "attention targeting" matters: pre-cutoff filings receive more investor attention. Their stocks are more liquid and their prices also converge more quickly to their long-run levels, especially after more complex filings.

We contribute to the empirical literature on attention management. This literature has documented a similar cooperative attention coordination mechanism in the context of Federal Open Market Committee announcements by the Federal Reserve (Boguth, Gregoire, and Martineau, 2018), downgrade announcements of rating agencies (Kraft, Xie, and Zhou, 2019), and information dissemination by NGOs (Couttenier and Hatte, 2016). We also document a cooperative form of attention targeting, but in the context of corporate news and investors.[2] Our paper is also close in spirit to the large body of accounting literature examining how firms improve disclosure. This literature shows that managers adjust their disclosure style or channel it to make it easier for investors to process information.[3] We link disclosure, more specifically the timing of news, to direct measures of attention and real effects on price convergence.

More generally, we contribute to the growing literature on costly information processing by showing how firms take this into account.[4] News can require processing time because it requires the acquisition of complementary information (cf. Kim and Verrecchia, 1994), involves the imperfect communication of qualitative information (cf. Dontoh and Ronen, 1989; Plumlee, 2003; Engelberg, 2008), or bundles many different elements together (cf. Segal and Segal, 2016). For example, understanding Item 5.02, "Departure of directors or certain officers," requires knowledge of the departing officer and of the circumstances, as well as the characteristics, of the expected replacement. The time spent reading and processing information can improve the interpretation and understanding of news, but also decrease the potential returns to trade.

Within the literature on the consequences of limited and costly attention,[5] we provide evidence for the theoretical literature on heterogeneous information processing abilities. Most relevant to our setting, Biais, Foucault, and Moinas (2015) and Di Maggio and Pagano (2018) theoretically show how releasing complex information can accentuate the information asymmetry between more sophisticated and less sophisticated

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[2] In this context, a related literature studies the strategic timing of news when firms and investors have conflicting incentives. This includes increasing attention to good news for insider trading (Lou, 2014; Edmans et al., 2018), acquisition payments (Ahern and Sosyura, 2014), or the obfuscation of bad news for insider trading plans and career concerns (Niessner, 2015), or with plans to taking remedial actions in the short term (Cohn, Gurun, and Moussawi, 2019). The coordinated timing of news that we document in our paper can not only co-exist with these non-cooperative motives; it can even complement them, as obfuscation is easier for firms with a reputation for transparency.

[3] Firms reduce disclosure complexity when their earnings are better (Li, 2008); when disclosure formats change (Blankespoor, 2019); when writing for a foreign audience (Lundholm et al., 2014); when mergers decrease the number of analysts (Balakrishnan et al., 2014); when financial statements are inherently hard to read (Guay, Samuels, and Taylor, 2016); and when news is spread over several days to help investors process it (Chapman et al., 2019).

[4] Sims (2003, 2006) argues that agents are unable to process all information and, accordingly, underreact to news. This is consistent with evidence in psychology (Pashler, Johnston, and James, 1998; Yantis, 1998) and in the experimental research on financial information processing (Libby, Bloomfield, and Nelson, 2002; Maines, 1995) and in asset pricing (Daniel, Hirshleifer, and Teoh, 2002).

[5] See, for example, Hirshleifer and Teoh (2003); Peng and Xiong (2006); Van Niewerburgh and Veldkamp (2009), (2010); Davies (2015); Pavan (2016); and Hirshleifer, Lim, and Teoh (2011).

investors. Less sophisticated investors avoid such markets, leading to lower liquidity and prices. Consistent with this argument, Miller (2010) documents lower trading volumes and a decrease in small trades after more complex 10-K filings. In the model proposed by Pagano and Volpin (2012), complex information exposes less sophisticated investors to a winners' curse. Therefore, issuers prefer opacity to avoid the implied under-pricing. Related literature shows similar liquidity-reducing effects of news in the presence of the heterogeneous endowment of complementary information needed to interpret that news (e.g., Kim and Verrecchia, 1994; Crego, 2020). Our paper contributes to this literature with evidence that is consistent with issuers trying to reduce adverse selection with the timing of their news disclosure.

In the growing presence of algorithmic trading and automated information processing (Brogaard, Hendershott, and Riordan, 2014; Pungaliya and Wang, 2018), one possible interpretation of our results is that firms try to release soft information at times when there is likely to be more human attention. More complex or qualitative information is hard to process automatically (Hendershott, Jones, and Menkveld, 2011; Zhang, 2018; Chakrabarty, Moulton, and Wang, 2017). Algorithmic processing can generate noise when applied to complex information, which affects information acquisition by humans (Foucault, Hombert, and Roşu, 2016; Baron et al., 2019; Yang and Zhu, 2020; Weller, 2018).

We also contribute to the empirical literature on news releases after market closure at 4:00 pm. Under the premise that investor attention is lower in the evening, this body of literature reports a prevalence of negative news announcements after market closure and interprets it as evidence of obfuscation (Patell and Wolfson, 1982; Segal and Segal, 2016; DeHaan, Shevlin, and Thornock, 2015; Niessner, 2015). Others use Fridays for the same purpose (e.g., Dellavigna and Pollet, 2009; Michaely, Rubin, and Vedrashko, 2016a and 2016b). However, Doyle and Magilke (2009), Gennotte and Trueman (1996), Michaely, Rubin, and Vedrashko (2014), and Kraft et al. (2019) question the assumption that investors are distracted after market closure: they document a stronger, not weaker, reaction to news announced outside of trading hours. Hence, comparing news before and after market closure cannot rule out the alternative hypothesis that firms disclose after-hours to give more time for the market to process the announcement (Patell and Wolfson, 1982; Doyle and Magilke, 2009). Consistent with this argument, Doyle and Magilke (2009) show firms with more volatile cash flows and more geographic and operating segments announce more news after hours, and Michaely et al. (2014) firms with better corporate governance do so. We contribute to this literature by documenting that these apparently contradictory results can be reconciled: the after-market period not only contains periods of investor inattention (after the cutoff), but also periods of high investor attention. We find evidence of a more cooperative version of attention management under which firms release hard-to-understand news at times of greater attention.

We describe our empirical strategy in the next section, and the data in Section 3. In Section 4, we show that investor attention is indeed higher just before the 5:30 pm cutoff, a necessary precondition for our empirical strategy. In Section 5, we present our main results regarding the timing of different filing types according to their complexity. In Section 6, we discuss the rationale for such attention targeting and provide evidence for faster price formation for pre-cutoff filings, especially for complex news and of better post-filing liquidity of the stocks of pre-cutoff filings. Section 7 provides robustness tests, and Section 8 offers conclusions.

2. Framework and institutional setting

In this section, we start by describing the institutional discontinuity at 5:30 pm at the center of our empirical strategy. We then present a simple analytical framework to illustrate the effects that we aim to capture empirically. Finally, we explain how we use the institutional discontinuity to estimate these effects.

2.1 Institutional setting

Our setting is 8-K filings accepted around 5:30 pm. The SEC publishes corporate filings in its online repository, the Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system. During the day, EDGAR makes corporate filings publicly available after a short, automated acceptance review that takes a variable amount of time – "no more than a couple of minutes" (Griffin, 2003). Filings accepted before 5:30 pm are published a few seconds after acceptance on the public EDGAR website, as well as via the Public Dissemination System to paying subscribers. The time from acceptance to posting can vary depending on the transmission technology (Rogers, Skinner, and Zechman, 2017; Bolandnazar et al., 2020).

However, filings accepted after 5:30 pm do not become visible immediately. Instead, all accumulated filings (270 on an average day in our sample period, of which 43 are 8-Ks) become simultaneously visible only when EDGAR reopens the next morning at 6:00 am. The 5:30 pm cutoff leads to a discontinuity in the ability to process news: investors have 17 hours to read and process the news between 5:30 pm and market opening (9:30 am), whereas they have only 3.5 hours between the morning release and 9:30 am. This short period also coincides with a large amount of other information released simultaneously at 6:00 am. The additional time between pre-cutoff news release and trading provides individual investors with more time to process the news. In addition, investigative journalists can use the additional time to complement information from EDGAR with other sources, e.g., interviews (Francis et al., 1992; Guest, 2021).

The cutoff and release times do not coincide with any other institutional features, such as market opening or closure times.[6] The regular hours for trading on stock exchanges in the U.S. are 9:30 am to 4:00 pm Eastern Standard Time (EST), and the time of the cutoff corresponds to 9:30 pm GMT (London), 10:30 pm GMT+1 (Frankfurt, Paris), 5:30 am GMT+8 (Hong Kong, Singapore, Shanghai), and 6:30 am GMT+9 (Tokyo). Indeed, the cutoff time lies outside typical business hours in Europe and Asia and is thus unlikely to coincide with the arrival of major news from abroad.

There are no discontinuous changes in Over-the-Counter (OTC) regimes at the cutoff or release times. OTC markets are largely illiquid at these times, only becoming more active after 7:00 am (cf. Barclay and Hendershott, 2003; Jiang et al., 2012; and Li, 2015). Despite the slow and illiquid nature of the OTC market, Gregoire and Martineau (2021) show, using data on earnings announcements, that the after-hours market provides most of the price formation: stocks with after-hours OTC trading have no significant price discovery at the opening of markets. Thus, illiquid after-hours trading allows traders to infer information from each other, slowly incorporating information from complex news. An early conjecture by Francis, Pagach, and Stephan (1992) is that, during the day, "chaotic traders" who observe a hard-to-process announcement attempt to make short-term profits by trading quickly. These uninformed traders are absent in the illiquid overnight OTC market, leading to a better price discovery process in the night and the avoidance of misleading cascades.

2.2 Analytical framework

We use the analytical model in this section to illustrate the timing decision for the release of complex information when considering how investors allocate attention. We then map the predictions of the model to our empirical results.

The agents of the model are a representative investor and a set of independent individual filers. Individual filers are firms, each with information about one single firm-specific event that they need to file. Filers decide on filing strategies according to their type. Their type is a measure of the complexity of the filing that we describe below and some other motives to file early or late. The investor decides on an attention strategy. For simplicity, we assume that filing and attention strategies are chosen simultaneously in advance before the filing window and then executed.

Filings:

[6] The officially allocated filing date changes after 5:30 pm. For this reason, we exclude from the sample the 64,952 filings made on or after filing deadlines. Thus, this date assignment has no consequences for the firms in our sample.

Consider a continuum of filers, indexed by C and ε, that choose between filing at an earlier or a later time period, $t \in \{E, L\}$.

The index $C \in [0, \bar{C}]$, with density $h(C)$, measures the complexity of the filing, defined as the number of different ideas it contains. For example, one could think of a filing with $C = 2$ as a filing with two different pieces of information we call ideas. In our empirical analysis, we proxy for the number of ideas in a filing using the number of filing items, the number of words, and the Fog index of linguistic complexity.

The index ε is a benefit (or cost, if negative) of filing "early", that is unrelated to the complexity of a filing. We assume that ε is independent of C and continuously distributed on the real line with density distribution $g(\varepsilon)$. We consider several potential reasons to file early in our empirical analysis, including the importance of news, catering to specific investors, or the working hours of filers. Each filer draws a C and ε, but there is no aggregate uncertainty about the realization of C or ε.

A filer chooses t to maximize $\pi(\alpha) + \varepsilon\, I_t$, where $\pi(\alpha)$ is the benefit that the filer achieves for receiving attention α, ε is the additional benefit of filing early, and I_t is an indicator that takes a value of one if a firm-filing is filed early. We assume that filers prefer more attention to less, $\pi'(\alpha) > 0$, and we also assume that, $\pi''(\alpha) < 0$ and $\pi'(0) = \infty$. We can think of $\pi(.)$ as the benefits of better price formation when investors pay more attention. In our empirical analysis, we use the speed of price formation and liquidity to measure $\pi(.)$.

Investors:

Investors decide on the aggregate level of attention they want to allocate to each period and how they want to distribute it across the different filings/ideas of each period.

Let a be the attention devoted to one of the ideas within a filing, and $f(a)$ the benefit of that attention for the investor. We assume decreasing returns to the attention allocated to each idea, with $f(0) = 0,\ f'(0) = \infty,\ f'(.) > 0$ and $f''(.) < 0$.[7]

Lemma 1 (investor attention across ideas): A representative investor optimally allocates attention equally across all the ideas in all the filings within a time period.

[7] Given that we focus on a representative investor, it is intuitive that investors as a whole spread attention to equate the marginal gains of attention across ideas. Individual, heterogeneous investors may, in practice, find it more profitable to know a lot about a few filings, and nothing about others. We abstract from these considerations in our stylised model.

Proof: See appendix for all proofs.

Lemma 1 allows us to define the strategy space as follows: For investors, we can focus on the aggregate attention allocated to each period, which we define as A_t. For each filer, given a C and the actions of all other agents, there is a threshold $\varepsilon(C)$ that determines filing early or late.

We define the attention per idea at time period t as $a_t = A_t/N_t$, where N_t is the mass of ideas each time period (i.e., the sum of all filings in the period times their respective complexity).

We assume that the total cost of attention is determined by $K(A_E + \lambda A_L)$, with $\lambda > 1; K(0) = 0,\ K'(.) > 0$, and $K''(.) > 0$ – that is, the overall cost of attention is increasing and convex in both A_t. Attention in the late period is more costly to investors, all else equal. This is encompassed in $\lambda > 1$, reflecting the institutional setting of releasing post-cutoff filings simultaneously and the shorter time for reading the filing before the market opens. Given this, investors allocate time to each regime to maximize:

$$max_{A_E,A_L} N_E f(A_E/N_E) + N_L f(A_L/N_L) - K(A_E + \lambda A_L).$$

Equilibrium

An equilibrium is characterized by the levels of aggregate attention A_E^*, A_L^*, and filing strategy $\varepsilon^*(C)$, that are best responses to each other. The mass of ideas in each regime in equilibrium, N_E^* and N_L^*, is determined by $\varepsilon^*(C)$ and the distribution of ε and C. (See the Appendix for details.)

The investor first-order conditions (FOC), evaluated at the equilibrium A_L^* and A_E^*, are:

$$f'(A_E^*/N_E^*) - K'(A_E^* + \lambda A_L^*) = 0 \text{ and } f'(A_L^*/N_L^*) - \lambda K'(A_E^* + \lambda A_L^*) = 0.$$

These imply that $f'\left(\frac{A_L^*}{N_L^*}\right) = \lambda f'\left(\frac{A_E^*}{N_E^*}\right) = \lambda K'(A_E^* + \lambda A_L^*)$.

Proposition 1 (equilibrium attention per idea): $a_L^* < a_E^*$, where a_t^* is the equilibrium a_t.

Given Lemma 1, the attention to a filing of a given complexity is Ca_t^*. More complex filings attract more attention per filing (but the same per idea) within a time period. Therefore, filers with higher C benefit more

from a higher a_t^* – that is, more attention per idea delivers a higher $\pi(C a_t^*)$ for more complex filings. This creates a complementarity between a and C. Filers sort themselves because $a_L^* < a_E^*$.[8]

Proposition 2 (equilibrium optimal filing strategy): $\varepsilon^*(C)$ is decreasing in C. As C increases, a larger fraction of filings is filed early.

Given that $\varepsilon^*(C)$ is decreasing in C, and that ε is independent of C, more complex filings are filed early than filed late. The presence of other motives to file, ε, guarantees that there are always filers that file early and late. An equilibrium is always interior, with $a_L^* < a_E^*$. Investors allocate attention to satisfy the FOCs.

Proposition 3 (equilibrium attention per filing) The average attention per filing is higher for early filings than for late filings.

We apply the ideas in this analytical framework to the empirical analysis of filings just before and just after the 5:30 pm threshold, corresponding to the early and late periods, respectively. While this setting provides a close empirical counterpart to this analytical framework, our framework is more general and applies to any two channels of information the filer may choose that have different attention costs. We now present our estimation strategy.

2.3 Estimation

The institutional change in the way filings are released around 5:30 pm creates two distinct time periods, where processing filings from the later period is more difficult. In contrast, all other institutional factors are continuous around this threshold. This empirical setting corresponds well with our analytical framework, as filings right after 5:30 pm should be harder to process (i.e., $\lambda > 1$) than those filed right before, while keeping all other institutional characteristics constant.

The two main outcomes of the analytical framework that we empirically verify are as follows:

1) The average attention per filing is higher for early filings compared to late filings (according to Proposition 3)[9].
2) Filers sort themselves according to their complexity – that is, filings in the high-attention period

[8] As filers are infinitesimal, they do not consider their impact on the equilibrium attention. However, in the aggregate, higher attention to complex filings and higher attention in the time period with more complex filings reinforce each other.

[9] Note that we cannot test $a_L < a_E$ directly, as our complexity measures are ordinal measures of the number of ideas in a filing, but harder to interpret in a cardinal way.

are more complex than those in the low-attention period (according to Proposition 2).

To understand how attention and filing complexity change in equilibrium at the discontinuity, our empirical strategy relies on comparing attention and filings just before the cutoff with filings immediately post-cutoff (those with $\lambda > 1$). To do so, we could compare the attention and characteristics of filings in an arbitrarily narrow interval before and after 5:30 pm. However, it is more accurate to take the limit as we approach the cutoff from either side.

Take a news characteristic Y_{ij}, which for our main results measures either the complexity or the number of downloads associated with a filing indexed by i. We can explain Y_i as a function of I_i, which indicates whether the filing comes before or after the cutoff, $f(t_i)$, a flexible functional form $f(.)$ of the filing time t, and an error term ζ_i:

$$Y_i = \beta_1 I_i + f(t_i) + \zeta_i. \qquad (1)$$

Given that $f(t_i)$ absorbs any continuous relationship between the filing characteristics and t_i, the coefficient of interest, β_1, captures only the discrete difference between filings just pre-5:30 pm and post-5:30 pm. That is, β_1 can be interpreted as the difference in Y_i as we take the limit to the right and to the left of the cutoff.[10]

To take this limit, we use different specifications that correspond to different ways of implementing $f(t_i)$. For the main results of the paper, we graphically show non-parametric regressions, allowing for a jump at 5:30 pm, as well as local linear regressions on an optimally determined bandwidth, as proposed by Calonico, Cattaneo, and Titinuik (2014) and by Calonico, Cattaneo, and Farrell (2020).

In addition to the comparison of filings just after (vs. before) the cutoff, we compare filings just before the cutoff to all overnight filings, given that they are all released at once. We estimate:

$$Y_i = \beta_1 I_i + fl(t_i) + \zeta_i, \qquad (2)$$

where $fl(t_i)$ captures only the continuous relationship between t_{ij} to the left (i.e., before) of the cutoff – that is, we compare the value of Y_i as we take the limit to the left of 5:30 pm with the average value of Y_i between 5:30 pm and the release of the overnight news the next morning.

[10] Alternatively, one could consider comparing the mean of Y_{ij} before and after the cutoff in increasingly small intervals. Our results are robust to taking such an approach.

To take the limit of the outcome variable to the left and right of the 5:30 pm cutoff, we use techniques developed in the context of regression discontinuity design (RDD) (Imbens and Lemieux, 2008; Lee, 2008; Lee and Lemieux, 2010) that are directly applicable to our context. However, while both our estimation and RDD techniques rely on the same strategy of taking limits of a conditional mean, our approach is not an RDD approach. In a standard RDD methodology, observations are quasi-randomly assigned to each side of the discontinuity, whereas in our setting, firms choose between two distinct visibility regimes. Our approach is thus close in spirit to the literature on selection and endogenous bunching at given thresholds – for example, Kleven (2016).

Three further results in the model require different methodologies, which we explain later in their respective sections. First, we show empirically that the benefit of filing early, ε, varies across firms for reasons that are not perfectly correlated with C. Second, we show empirically that investor attention within time periods increases in complexity, which follows from investors spreading their attention across ideas. Finally, we show empirically that more attention per filing is associated with better price formation. To be more precise, price formation is better for a given filing complexity, $\pi(a_E^* C) > \pi(a_L^* C)$ for any C, as well as for the average early filing given that it is more complex. More complex filings have better price formation when filed early rather than filed late: $\pi(a_E^* C_1) - \pi(a_E^* C_2) > \pi(a_L^* C_1) - \pi(a_L^* C_2)$ for every $C_1 > C_2$.

3. Data

3.1 Current reports

Our sample comprises current reports by U.S.-listed firms between September 2004 and March 2012. Current reports (8-K filings) are mandatory reports on material events. Unlike almost all other reports, their timing is not periodic but follows the events (with a deadline of four business days after the event and a fine for late filings).[11] These events include scheduled ones to which investors can turn their attention but, importantly, they include the universe of unscheduled and unexpected material events. We obtain their acceptance time and items from EDGAR and use the actual filings to study their content and complexity.

[11] The exceptions are Regulation Fair Disclosure filings (Section 9), which have a deadline of 24 hours after previous disclosure, and voluntary filings (typically Section 8), which do not have a deadline. Excluding or including these filings does not qualitatively change our results.

We exclude filings on or after the deadline date, as their timing may not be as deliberate and may also reflect motives outside attention management.[12] This exclusion also applies to Regulation Fair Disclosure filings, which have a 24-hour deadline. In addition, we exclude filings that are not likely to be unexpected because they may be subject to pre-announcement information acquisition (cf. Kim and Verrecchia, 1991 and 1997). Following Callen, Kaniel, and Segal (2019) and Niessner (2015), these filing items are earnings announcements (Item 2.02: "Results of operations and financial condition") because they are often scheduled (Boulland and Dessaint, 2017), and "Bankruptcy and receivership" (Item 1.03), which comprise the only set of filings for which the literature has documented a return reaction prior to the announcement date. This results in a final sample of 232,895 out of 442,073 filings (Table 1 Panel A).

Figure 1 shows the distribution of the number of 8-K filings in our sample throughout the day. Filing activity peaks in the 90-minute period after market closure at 4:00 pm (49% of all 8-Ks: cf. Michaely et al., 2014; and Bagnoli, Clement, and Watts, 2006 for earnings announcements). The 10-minute interval with the highest filing activity (6% of the total) occurs just before our focal cutoff, between 5:20 pm and 5:29 pm. This heightened afternoon disclosure activity is consistent with recent literature that documents price formation activity between market closure and market opening (e.g., Cliff, Cooper, and Gulen, 2008; or Lou et al., 2019). Throughout the night, 3% of filings accumulate and become public at 6:00 am next morning. In total, 37% of the filing volume occurs between 4:30 pm and 6:00 am, the focus of our paper.

3.2 Measuring attention

We use the download traffic log for the EDGAR website as a measure of the amount of attention paid to filings (as in Lee, Ma, and Wang, 2015; Drake, Roulstone, and Thornock, 2015 and 2016; or Bauguess, John, and Hanley, 2018). That traffic includes the IP addresses of many institutional investors, as well as non-identifiable addresses of individuals or small firms (cf. Chen et al., 2020). Not all investors access the EDGAR website directly for filings and related news; therefore, the download volume does not capture the universe of attention. In particular, the traffic data exclude the small number of clients who subscribe directly to an EDGAR live feed provided by a third party (Bolandnazar et al., 2019), as well as clients who use secondary news providers such as Bloomberg (Ben-Rephael, Da, and Israelsen, 2017). However, Ben-Rephael et al. (2017) show that the number of downloads is a good proxy for overall investor attention and highly correlated to second-degree attention measures, such as Bloomberg searches and reading activity. In addition, Iliev et al. (2021) and Crane et al. (2022) show that large shareholders frequently access EDGAR

[12] These consist of 24,051 late filings and 40,901 on-deadline filings. The median late filing is 16 business days late, and the mean is 38. Only 4,025 filings fall on the day just after the deadline.

directly for information. Media attention itself is not a useful measure in the setting of 8-K filings. On average, only 2.9% of filings receive sufficient attention for the firm to have a significant event listed in CapitalIQ, and 3.1% of filings appear in newswires (PC Newswire and ECN) on the filing day.

Automated scripts have become increasingly popular; the fraction of non-automated downloads decreased from an average of 19% in 2004 to 14% in 2012 (Table 1 Panel A). In our analysis, we will mostly exclude automated downloads, but we will show that our results are robust to including them. The median number of non-automated downloads during the first 24 hours after filings become available is eight (Table 1 Panel B), and the median number of total downloads is 40.

3.3 Measuring complexity

We measure complexity – how hard it is to process a filing – through dimensions of content, scope, and readability. First, firms classify 8-K content by "items." For example, corporate governance items include "Change in Control of Registrant," "Departure of Directors," "Amendment of By-laws," etc. We use the count of items of a filing as a measure of content complexity: i.e., the more consequences one single event has, the harder it is to determine its price impact. The median filing has two items (Panel B of Table 1).

As a measure of the scope of complexity, we count the length of the text, as recommended by Loughran and McDonald (2014). To avoid counting pictures as more complex, we use a simple word count instead of the actual file length. The median word count of a filing including all attachments is 740, and the median word count per attachment is 726.

Finally, we use the Gunning (1952) Fog index to measure the complexity of the writing:

$$\text{Fog} = 0.4\ (\text{avg. number of words /sentence} + \%\ \text{of words with more than two syllables})$$

Lower Fog values indicate a more readable text. The scaling by 0.4 allows us to interpret the resulting index as the number of years of schooling required to understand a text. To avoid biasing the index with non-text content, we remove tables and capitalized words (unless most words are capitalized) and filings with fewer than three sentences or 50 words. Consistent with Loughran and McDonald (2014), the median Fog score is 17, which implies that readers need 17 years of schooling to understand an average 8-K filing.

3.4 Measuring liquidity

We study post-filing liquidity in terms of volume, spreads, and stock volatility. We use data from the NYSE Trade and Quote database, as calculated in the WRDS Intraday Indicators suite. All measures are estimated for market hours on the day after the filing.

To measure trading volume, we use the total number of trades and the total trade value in dollars. The mean dollar trading volume on the day after the filing is 59 million, and the mean number of trades on that day 8,454. We also separate "buy" and "sell" volume classified by the Lee and Ready (1991) algorithm, where the trade is classified as "buy" if its price is greater than in the previous nanosecond (millisecond before July 25, 2015; microsecond between July 25, 2015 and October 23, 2016), and "sell" if smaller. Sell and buy volume are on average 1.34 million in buy and 1.33 million in sell volume.

To study price spreads, we use the quoted spread and the realized spread. The realized spread is $\frac{2D_k(P_k - M_{k+5})}{M_k}$, where P_k is the price of trade k, M_{k+5} is the bid-ask mid-point five minutes after trade k, and D_k is $+1$ for a trade classified as a "buy" and -1 for one classified as a "sell" by the Lee-Ready algorithm described above. We take the time weighted (simple) average of the quoted spread and the share volume weighted average of the realized spread. The mean realized spread is 56 bp, and the mean quoted spread is 85 bp.

Finally, we calculate intraday stock volatility using second-to-second returns of the bid-ask mid-price. We use the last NBBO update for the quotes and do not populate seconds without quotes. The mean intraday volatility is 0.2 bp.

4. Investor attention

In this section, we show how investor attention varies with filing time and complexity.

4.1. Attention to filings around the 5:30 pm threshold

We begin by showing how attention changes around the 5:30 pm threshold. We measure attention as the number of downloads per filing. Figure 2 shows the coefficients of non-parametric regressions, allowing for a jump at 5:30 pm.[13] Given that there is a lag between the actual filing time (which we do not observe) and the timing of its acceptance (which we observe), we exclude from the analysis filings accepted in the

[13] The regressions use a bandwidth of 30 minutes. We use a triangular weighting to produce smooth graphs by reducing the influence of the last observations included and excluded from the window. All results are robust to alternative weightings or to uniform weighting.

five-minute period just after 5:30 pm (up to 5:35 pm), which could have been filed prior to the cutoff.[14] A red horizontal line reports the average attention to overnight filings.

The download counts show a significant discontinuity around the 5:30 pm cutoff. There is a sharp drop in investor attention to the filings accepted immediately post-cutoff, as well as in the average of all overnight filings. These results are already visible in the first 5 minutes after a filing becomes available (Panels A and B of Figure 2), and persist until the market opens (Panel C) and during the first 24 hours after publication (Panel D). Before the cutoff, initial download numbers per filing in the first 15 minutes are similar for all filings. Indeed, over the first 24 hours after publication, investors pay the most attention to the filings from just before the cutoff. This discrepancy between initial and subsequent download numbers also suggests that earlier time slots within the post-closure period do not have an advantage in attracting attention; if anything, the later ones do. While these graphs depict the downloads per filing, aggregate download patterns are similar qualitatively and quantitatively. These results confirm our assumption that investor attention shifts down post-5:30 pm (see Appendix 1.3).

In Table 2, we report the results of the corresponding regressions. The pre-cutoff filings are downloaded more often: 0.7 more in the first 5 minutes (column 1), 17 more before market opening (column 3), and 19 more in the first 24 hours after publication (column 5). This corresponds to 20% of one standard deviation for the first 15 minutes, 47% for the downloads before the market opens, and 28% for the first 24 hours.[15] While the pre-cutoff filings already receive more downloads in the first 15 minutes, that difference increases before market opening. The counts including automated downloads exhibit a similar pattern (15, 148, and 161 in Columns 2, 4, and 6, respectively, corresponding to 65%, 120%, and 82% of one standard deviation). The higher magnitudes indicate that crawlers do not read all filings but discriminate (based on items or firms) or are triggered by events other than publication (i.e., media reports or price movements). The numbers are smaller if we compare pre-cutoff filings to all overnight filings (Table 2 Panel B), by 11% for five-minute-downloads (12% excluding automated), by 34% (44%) for downloads before opening, and by 25% (25%) for 24-hour-downloads.

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[14] More specifically, given that it takes a variable time to approve and timestamp a filing (on average two to three minutes) and EDGAR reports only the time of acceptance, we cannot accurately assign filings in the 5:30–5:35 pm period to the pre-cutoff or post-cutoff regime. In the Appendix (Figure A.1), we graphically show our main results (downloads and filing complexity) with all the observations, including the 5:30 pm–5:35 pm ones. The results suggest that some of these filings were indeed filed pre-cutoff. While the inclusion of these additional observations narrows the gap in the estimates, all the results remain significantly different from zero and qualitatively unchanged.

[15] The 19 downloads in the first 24 hours compare to five downloads of proxy filings per day by mutual funds in the (-90,30) window around the annual meeting, as reported by Iliev et al. (2021).

4.2 Attention across time

The previous subsection suggests that the attention gap between pre-cutoff and post-cutoff filing persists from the first 5 minutes up to the first 24 hours. We now explore this time path in more detail and show that the difference in attention between pre-cutoff and post-cutoff filings increases steadily over time, with no reversal.

Figure 3 shows the difference in downloads between pre-cutoff and post-cutoff filings over time, estimated from regressions as reported in Table 2 (i.e., coefficients for the jump in downloads at 5:30 pm from non-parametric regressions). The x-axis shows the interval for calculating the download numbers as the dependent variable (in five-minute intervals up to the first hour, and per hour afterward). Panel A shows the results excluding automated downloads. The download gap increases steadily over time, with the steepest ascent in the first 15 minutes and only flattening after five hours. This steep ascent is consistent with Fedyk (2021), who shows that most of the price effects of more visible news are most pronounced in that time period. The differences in her setting are purely due to the enhanced visibility of otherwise similar news and diminish mostly in the first few hours, with large estimation errors after one hour. In contrast, the difference in attention to pre-cutoff vs. post-cutoff filings persists, grows over time, and continues to be precisely estimated. These results confirm that investors are indeed using the reading time during the night more intensely than in the morning hours, when there is more competition for their attention.

Panel B reports the difference between pre-cutoff and post-cutoff filings for all downloads, including automated ones. In the first five minutes after filing, pre-cutoff filings already receive on average 15 more downloads than post-cutoff filings. The ratio then ascends gradually, but monotonically. The concentration in the first five minutes is consistent with Alleen et al. (2018), whose evidence suggests that filing-based algorithmic trading is most active in the first five minutes after the filing becomes public and ends rapidly afterward. Despite the low marginal cost of machine processing one more filing, post-cutoff filings receive fewer downloads.

How does attention change throughout the overnight hours? To answer this question, we show, in Figure 4, the mean number of downloads per hour of download, separately for pre-cutoff filings (4:30–5:30 pm, black) and post-cutoff (5:35–6:30 pm, blue) filings. First, attention decreases during the night. Most downloads of filings made between 4:30 and 5:25 pm (black) happen within the first two hours. Downloads continue during the night, at a low level. The numbers increase somewhat in the morning as work hours start. Second, pre-cutoff filings are always downloaded more often than post-cutoff

filings (5:35–6:30 pm, blue). This suggests that readers recognize these filings as being more important rather than simply reading whatever has been just released.

4.3 The distraction effect of simultaneous filings

A central feature of our empirical setting is that the cost of processing is higher post-cutoff than pre-cutoff. One reason for this discrepancy is the longer time available to read pre-cutoff filings. Another is the potential information overflow when all overnight news is released at 6:00 am. This section provides empirical evidence for the latter negative causal effect of the simultaneous release of news on attention. For that purpose, we expand our analysis to the universe of non-overnight filings (including non-8-K filings) to show that, in general, the simultaneous release of more news is associated with fewer downloads.

In Figure 5, we show the number of downloads in the first five minutes after posting as a function of the overall number of simultaneous filings (including, but not restricted to, 8-Ks, normalized to percentiles). The download volumes in the first five minutes after regular filings are higher when there are very few filings at the same time, and the volume rapidly decreases throughout the first 25 percentiles. The small download rates of overnight filings are consistent with Hirshleifer, Lim, and Teoh (2009); DeHaan, Shevlin, and Thornock (2015); and Blankespoor, DeHaan, and Marinovic (2020), who all show a delay in stock price reactions to earnings news on days with more earnings announcements. For comparison, the average number of simultaneous releases of overnight filings (270) is higher than the maximum number of filings in any other five-minute bracket throughout the day.

Table 3 confirms these results in an Ordinary Least Squares (OLS) regression. In Table 3, Panel A, we regress the number of downloads on the number of filings filed in the same five minutes, controlling for year, month, day of the week, and firm fixed effects; there is also a separate indicator for overnight filings. The download count is significantly lower in the presence of more filings in the same five minutes (Column 1). One standard deviation of the number of contemporaneous filings (681.51) corresponds, on average, to 0.11 more downloads. An average overnight filing receives 1.4 fewer downloads in the first five minutes than other filings. The download numbers are also significantly lower for overnight filings and filings with many contemporaneous filings if we include automated downloads (Column 2). When we count all downloads in the first 24 hours after publication, the magnitude of the download drop for overnight filings increases to sevenfold without automated downloads (Column 3) and fourfold when they are included (Column 4). Controlling for overnight filings, the number of other filings in the same five minutes does not matter significantly for the number of downloads in the first 24 hours (Column 4), suggesting that attention to non-overnight filings is more evenly distributed across time.

In the regressions in Table 3, Panel B, we capture the nonlinear effects suggested by Figure 5. The regression results are consistent with the graph: the number of downloads falls monotonically with the number of contemporaneous filings up to the 21–25th percentiles, with larger effects for smaller numbers of contemporaneous filings. Compared to filings with contemporaneous filings in the 0th to the 5th percentile, filings with contemporaneous filings in the 6th to the 10th percentiles receive two downloads fewer in the first five minutes (12 downloads in the first 24 hours after publication). This compares to a sample mean of 16 downloads in the first five minutes (see Table 1).

4.4 Attention to complex filings

Our framework assumes that investors spread attention across ideas and therefore pay more attention to more complex news, but this needn't be true. For example, sophisticated algorithms may be able to understand all kinds of 8-K filings alike, with no further processing time required. In this section, we provide evidence that investors indeed pay more attention to more complex filings. To this end, we regress download counts on our measures of complexity, separately for each measure, and separately for different timing periods:

$$N_{icj} = \beta_{cj} C_{ic} + \mu^{\Psi} i + \mu^{M} i + \mu^{\Delta} i + \mu^{\Omega} i + \varepsilon_{icj} \text{ if } t_i \subset Tj \qquad (3)$$

where, for each filing i, c is the complexity measure (such that C_{ic} is either the number of items, the length of the filing, or its Fog), and $\mu^{\Psi} i$, $\mu^{M} i$, $\mu^{\Delta} i$, and $\mu^{\Omega} i$ are the year, month, day of the week, and firm fixed effects (we confirm, in alternative regressions, that the results hold without firm fixed effects). We run these regressions separately for time buckets: t_i is the time of the filing, and j is either 9:30 am–3:59 pm (trading hours), 4:00–5:30 pm (pre-cutoff, afternoon), or 5:35 pm–5:59 am (post-cutoff, overnight).

Table 4 reports the results. Each column represents a time period, and each row depicts the coefficient of (separate) regressions, with its complexity measure as the key independent variable. More complex filings receive significantly more downloads, except if they are filed overnight (after the cutoff). These correlations are significant for five-minute-download counts (Panels A and B) as well as for 24-hour counts (Panels C and D); with (Panels A and C) and without (Panels B and D) automated downloads; with (Columns 1–2) and without (Columns 4–5) firm fixed effects; and for all measures of complexity.

For overnight filings, 24-hour download counts are significantly higher for all complexity measures except for total length (and marginally for Fog). However, five-minute download counts are not, indicating that investors only process these with a delay. The significant coefficients are markedly smaller than for filings before the cutoff, suggesting that attention reacts much less to complexity for overnight filings.

5. Firms: The timing of complex news

This section reports our main analysis: a comparison of the filings to the two sides of the cutoff.

5.1 Complexity around the cutoff

We use the same econometric approach as for the download patterns in the previous section. Allowing for a jump at 5:30 pm, Figure 6 shows the coefficients of non-parametric regressions. Panel A shows the number of items per filing (content), Panel B shows the Fog index (readability), and Panels C and D show the word count (scope) as an average per attachment and in total.

A significant discontinuity around the 5:30 pm cutoff is evident for all four measures of complexity. There is a sharp drop in filing complexity immediately after 5:30 pm. Like the filings immediately post-cutoff, overnight filings are, on average, also less complex.

Prior to the cutoff, complexity rises steadily to a peak at the point of maximum investor attention, just before 5:30 pm. There could be many reasons for this, but an important determinant could be the general decrease in market liquidity in the OTC markets toward the end of the day. Trading opportunities decrease, providing less distraction and more reading time for the next large trading opportunity at market opening. Firms may also prefer to release complex news when OTC trading opportunities are low to avoid informational cascades or the trading of their stock when the information across investors is very asymmetric. A steady increase in the fraction of more complex filings throughout the period after market closure is therefore equally consistent with attention targeting.

In Table 5, we report the results of the corresponding regressions. Pre-cutoff filings are classified into more categories per filing: pre-cutoff filings have 0.27 more category items, both compared to filings immediately post-cutoff (Panel A) and to the average overnight filing (Panel B). This corresponds to 0.31 (0.30 for the comparison to all overnight filings) of one standard deviation of the number of items. Pre-cutoff filings are also longer than post-cutoff filings, with a difference of 1,106 (vs. just post-cutoff; 982 vs. all overnight in Panel B) words per attachment or 4,498 (4,207 in Panel B) words per filing. This corresponds to 0.26 (0.23 in Panel B) of one standard deviation in terms of words per attachment, and to 0.19 (0.18 in Panel B) in terms of the total number of words. As for readability, pre-cutoff filings receive a smaller Fog by 0.7 compared with immediately post-cutoff filings (0.6 compared with overnight filings). This corresponds to 0.12 (0.10) of one standard deviation of Fog.

Jointly, these results show that firms release more complex news just before the 5:30 pm cutoff than afterward. In other words, firms match the complexity of the news to the investor attention regime. By

doing so, firms give analysts and investors time to read complex news before trading starts. Consistent with aiming for better and more symmetric information to facilitate trading on complex news, firms match more complex news to a higher expected level of attention.

5.2 Types of news vs. *types of firms*

Our main results pool all the filings of different firms. However, we can take advantage of the panel structure of the dataset (firms and filings) to disentangle whether sorting filings into different time slots operates at a firm level (i.e., whether firms with given characteristics prefer to file regularly at different times) or within firms (i.e., whether a given firm prefers to file different news at different times). To distinguish within-firm from between-firm effects, we run regressions over the full support of after-hours filing times (4:30 pm–6:00 am) and saturate the model with order-5 polynomials on t_{ij} (following Lee and Lemieux, 2010). This approach allows us to keep the focus on the 5:30 pm threshold while being able to run between-firm regressions (Table A.1, Panel A), or to add firm fixed effects (Panel B). The between-firms estimator provides results from regressing firm averages of the dependent variable on firm averages of the independent variables. Given that these are pure cross-sectional regressions, they capture how different types of firms are more likely to file in different time slots. The firm fixed effects estimator absorbs any time-invariant additive effect. One can interpret it as a pure time series within-firm effect that measures the deviations from a firm's average filing policy.

The pattern in both sets of regressions is similar to that in the main results. Post-cutoff filings are less complex in terms of length, readability, and scope. The pattern is present in both the time series and in the cross section, but it is quantitatively more intense within firms by a magnitude of two (Fog) to four (length and number of items). Indeed, the between-firm effect is not present for the average Fog measure.

The magnitude of coefficients is also larger within firms than between firms relative to the (within and between, respectively) standard deviations of the dependent variables. We report the relative size of each coefficient, as well as the standard deviations, in Table A.1: for example, the between-firm standard deviation of the number of items is 0.52 items, while the within-firm standard deviation is 0.83 items. The effect at the threshold corresponds to 10% of one standard deviation for the between groups estimation, and to 26% for the fixed effects estimation. A similar pattern arises for the other dependent variables.

Overall, the results in this section show that the main effects of the paper are present at both the firm level and the news (within-firm) level. The patterns are more intense within than across firms for three out of four measures, suggesting that, within a given firm, firms deliberately decide to time the disclosure of specific news to target attention.

5.3 Filing agents

Most firms use contractors to make SEC filings. Such filing agents help firms improve their filing readability, especially for 8-K filings (Alleen, DeAngelis, and Moon, 2018), and calibrate the timing of releases to manage attention.[16] The sophistication and strategies of each filing agent may thus affect the attention timing strategy of its clients. We study this hypothesis using SEC filing identifiers (accession numbers) that include an identifier for the filing agent.

We report the results in Table A.2. The specification is based on the one in Table A.1, except that it replaces firms with filing agents to estimate between-agent and within-agent effects. Filing agents exhibit time series and cross-sectional patterns that align with our main results. Filing agents with more complex filings are more likely to file pre-cutoff. This may be because firms actively seek out certain filing agents for filings that require more attention management. Within the filing pool of a given filing agent, more complex filings are also more likely to be filed pre-cutoff. The magnitude of the coefficients is larger for the within-filing agent case in absolute terms, although, relative to the standard deviation of each specification, the effects are more balanced.

5.4 Item types

In this section, we investigate how the variation within item and between item types identifies our results. To do so, we run additional RD regressions (replicating the main results in Table 5), but adding the filing types as controls. Note that this exercise is similar to the calculation of within-firm or within-filing agent results in Sections 5.2–5.3; however, we need to modify our approach because a filing may contain several items, and therefore categories are not nested.

The results are reported in Table A.3. The overall picture is qualitatively unchanged when we control for filing type. The Fog results are virtually unchanged. The length results are still significant, but of a smaller size. The number of items result disappears, which is to be expected as the number of items correlates closely with the type of items. Overall, these results indicate that some of the variation in our main results is driven by the sorting of certain item types to each side of the cutoff.

[16] See S. Dewan, 2012. An S.E.C. filer's nightmare: Making it public too soon, *New York Times* Oct. 18. Available at https://www.nytimes.com/2012/10/19/business/filing-reports-with-sec-too-soon-can-be-costly.html. We have verified in conversation with a filing agent that it is indeed common for firms to instruct them to file at a certain time, especially within the after-hours period.

5.5 Other costs of filing early vs. late and heterogeneity of results

Our framework requires that filers have other reasons to choose the time of filing other than complexity. These are summarized in a reduced form by the parameter *S* in our analytical framework. In this subsection, we study additional potential determinants of the timing of filings. We show that these other motives are relevant and may explain why firms choose filing slots for reasons other than attention. To study these additional motives, we first compare the difference in density to the left and right to the thresholds (Cattaneo, Jansson, and Ma, 2018) to show that firms also sort themselves according to these other dimensions. We then show that these additional factors are not driving our results by repeating the analysis of complexity around the threshold in subsamples where they are more relevant. Finally, we show that correlations between these additional factors and complexity are very low, corresponding to the assumption in our framework that they are largely orthogonal to the benefits of attracting higher attention to a filing. As most of these factors do not change at the threshold but throughout the night, we compare pre-cutoff filings to all filings overnight, controlling for time polynomials of order four to each side of the discontinuity. Univariate statistics for these additional measures are reported in Table A.4.

First, the time zone may account for a difference in the cost of filing late. In Table A.5, we report the differences in the number of filings around the cutoff for firms headquartered in the EST vs. those for firms headquartered in the Pacific Standard Time (PST) zones. At the time of the 5:30 pm EST cutoff, the West Coast is still only halfway through its business day. Indeed, East Coast firms have a significantly greater number of filings just left of the cutoff, compared to West Coast firms. We repeat our baseline regressions in Table A.6, Panel A: they hold in both subsamples. Regardless of location, pre-cutoff filings are more complex than those filed post-cutoff. The before–after difference in filing complexity is significantly larger for PST firms (for the number of items and filing length). This pattern is not consistent with a large end-of-day change in event complexity. Rather, it suggests that PST firms time the filing strategically so that it takes place at the end of the day.

Second, firms may release more relevant news after market closure (at 4:00 pm) to avoid price swings (Michaely, Rubin, and Vedrashko, 2014; Gregoire and Martineau, 2021). Indeed, filings in the highest quintile (per year) of next-day trading volume and those in the highest (per year) quintile of absolute values of returns are less likely to be filed after the cutoff (Table A.5), suggesting that the importance of news is a factor in determining the timing decision. Our baseline results hold both for the highest and lowest quintiles of relevance, measured as turnover as well as the absolute value of 10-day returns (Table A.6, Panels B and C). The before–after difference in the number of items is significantly larger for news with less subsequent trading volume, but smaller for news with less subsequent returns.

Firms may report less relevant news with less urgency. This should lead to more remarked differences just after the event. However, the around-cutoff density difference is higher for news reported later (over two business days after the event), not lower (Table A.5). Our baseline results hold both for the subsample of filings in the two business days after the event, and for those filed later (Table A.6, Panel D). The only significant between-subsample difference in coefficients relates to the number of items: the before–after cliff is more pronounced there for later filings.

Third, firms may use low-attention time periods strategically to hide bad news. Indeed, previous literature (DeHaan, Shevlin, and Thornock, 2015; Doyle and Magilke, 2009; Dellavigna and Pollet, 2009; Patell and Wolfson, 1982) interprets the release of negative news during the whole after-hours period as an attempt to hide bad news during periods of low investor attention. However, the around-cutoff drop in filing probability is no different between the filings with the highest and the filings with the lowest 10-day returns (Table A.5). If firms really try to obfuscate by filing either before or after the deadline, they succeed so well that investors are not able to detect it within a 10-day window. Finally, we find no differences between the subsamples with the highest vs. lowest 10-day returns (Table A.6, Panel E). Our baseline results hold in both samples.

Note that our results do not rule out that firms use the overnight period for obfuscation. Obfuscation can be effective only if attention is low and, for that condition to be true, the timing of news cannot be a strong signal of its nature. Therefore, a strong correlation between timing and returns would reduce the effectiveness of obfuscation: that is, there must be other sufficient motives for firms to file in the overnight period. Obfuscation may also be part of a mixed strategy in which firms file bad news at different times, precisely to improve the effectiveness of obfuscation.

Firms may also have different incentives when filing their bad news. While the low attention of the late period may be useful for obfuscation, if some investors are naïve or overconfident about the strategic use of complexity (as in Jin, Luca, and Martin, 2022), then firms also have an incentive to make bad news seem more complex and pool with good filings before the deadline. In our sample, however, complexity is not significantly related to negative returns. Table A.7 shows the coefficients of regressions of returns (from the closing price before filing to the opening price after filing in Panel A; 10-day returns in Panel B) on our measures of complexity, separately for each measure, and separately for different time periods. If anything, complexity is related to positive, not negative returns – but only significantly so for very few specifications.

Fourth, shareholders may have heterogeneous preferences in their timing preferences, and firms may cater to those. We examine several measures of ownership: the fraction held by all institutions; the fraction held by foreign institutions; ownership concentration, all as reported in Factset; and ownership by dedicated

shareholders, quasi-indexers, and transient investors as classified by Brian Bushee. We compare the highest and lowest quintiles (by year) of each of these (Table A.5). Firms in the lowest quintile of institutional ownership and in the highest quintile of quasi-indexers file significantly more often to the left of the cutoff, and firms in the highest quintile of transient investors file significantly more often to the right of the cutoff. To the extent that firms indeed cater to their shareholders, these results suggest that retail investors, quasi-indexers, and non-transient investors prefer reading new filings during the night to reading them in the early morning. Our main results – which show higher complexity filings to the left of the cutoff – hold and remain significant for all these quintiles (see Table A.6, Panels F-K). When comparing subsample coefficients, only the drop in the number of items is significantly different between subsamples: greater for quintiles with less institutional, notably foreign ownership, fewer dedicated investors, and greater ownership concentration. This is consistent with firms catering more to the attention of investors that are more likely to trade upon news (retail, domestic, short-term) or affect prices (institutions with larger stakes).

Fifth, we study the effect of differences in the information environment on the filing decision. Firms may want to avoid filing after the cutoff if macroeconomic news are due in the morning. Indeed, there are significantly fewer filings right of the cutoff on nights before scheduled macroeconomic news listed by Bloomberg (Table A.5). The same may be true for nights with a higher amount of industry news. We compare the highest and lowest quintiles in the number of filings from firms with the same SIC industry code. On days with more registration filings, firms are significantly more likely to file just before the cutoff, giving readers more time to digest the information. Other filings are not significantly related to the number of filings around the cutoff. We also consider the number of analysts that cover a firm, and the standard deviation of their forecasts. Neither has a bearing on the number of filings around the cutoff. Our main results (Table A.6, Panels L-S) hold and remain significant for all these quintiles.

We also report, in Appendix 2, how our results change over time, with firm characteristics, and between Fridays and other days. Appendix 2 also reports univariate statistics of the measures listed above, as well as their correlation with the complexity outcome variables. We show that these correlations are below 5% for almost all of them, consistent with our assumption in the analytical framework that they are orthogonal to attention targeting.

6. Why do firms target attention?

The previous two sections have shown i) that investor attention is higher just before the 5:30 pm cutoff, and ii) that firms release complex news before the threshold. In this section, we discuss why firms match complex news to greater investor attention. We start with a discussion of the literature and then provide in-

sample evidence for the existence of a causal effect of attention on the speed of price formation and on the subsequent liquidity of the stock.

6.1 Existing literature

The theoretical literature suggests that slow and uneven information processing exposes investors to unknown information, and thus to idiosyncratic risk (Klein and Bawa, 1976; Barry and Brown, 1985; Coles and Loewenstein, 1988; Zhang, 2006; Fedyk, 2020). Moreover, investors avoid securities that expose them to adverse selection (Pagano and Röell, 1996; Amihud, 2002; Shapiro, 2002; Biais, Foucault, and Moinas, 2015; Di Maggio and Pagano, 2018). Firms should therefore avoid releasing complex news at low-attention times and experience smoother price formation if they release them at high-attention times. In this section, we show that this is empirically the case.

The empirical literature also suggests that time-varying investor attention matters. Gargano and Rossi (2018) show large returns to investor attention. Fedyk (2020) shows how time-varying attention (caused by the accessibility on the Bloomberg page) increases trading volume and exacerbates differences in opinion. Peress and Schmidt (2018) use the length of headline news segments and TV viewership data as a quasi-random source of variation. They focus on the heterogeneous impact of this news across investors and show that adverse selection risk is exacerbated at moments when less informed investors are less attentive. All these results imply that firms have an incentive to target attention regimes that reduce adverse selection.

6.2 Speed of price formation

In this section, we complement our results on the timing of news with evidence on the impact of attention on the speed of price formation.[17] We follow Fedyk (2021) and Peress and Schmidt (2018) and study the speed of convergence toward a long-run price. As in both papers, we expect that prices should converge faster under higher attention (for filings before 5:30 pm). For each side of the cutoff, we measure the returns from closure (before the release of news) until open, at the end of one day and at the end of two, three, five, and 10 days. We condition on the return after 10 days being positive or negative and analyze both subsamples separately.

[17] Note that the attention variation in both Fedyk (2021) and Peress and Schmidt (2018) is unpredictable for firms, making their settings ideal to study how price formation is affected by attention, while keeping the nature of news constant. In contrast, to study the timing decision of firms, one needs a predictable change in expected attention, as in our setting (see Djourelova and Durante, 2021, who study the timing of presidential orders given by U.S. presidents).

To attenuate the selection to each side of the threshold, we reweight the post-5:30 pm observations using an entropy matching procedure on a comprehensive set of variables.[18] In particular, we match the samples on several observable characteristics, including their 10-day returns, separately for positive and negative news: thus, we are reporting pre-10-day returns for news that eventually converge to the same cumulative returns. In our sample, more complex news self-selects to the pre-threshold period. This selection should bias the results toward a slower convergence for pre-threshold filings. The matching procedure on variables that measure complexity aims to attenuate this selection. The inclusion of other matching variables reduces other selection margins (i.e., other than complexity) across both subsamples.

For pre-cutoff (high-attention) filings, the final average matched 10-day return is 7.6% for positive returns (Panel A of Table 6) and -8.1% for negative returns (Panel B). Low-attention filings converge more slowly to this return than their high-attention counterparts. During the first night, positive low-attention filings move prices by 4.2% from close to open. This compares to 6.3% for high-attention filings. Thus, low-attention filings converge by 2% points (or 32.4% of the high-attention filing returns) less toward the final returns. For negative news, the difference in convergence is 67.5% for the first night. The absolute difference of returns keeps growing during the first day of trading, although the relative difference between them starts decreasing. Afterward, the distance between the returns of the two regimes decreases both in absolute and in relative terms as stock prices converge toward the 10-day figures. The results show that the return reaction for filings before the 5:30 pm threshold converges toward the long-term return faster than for filings after 5:30 pm.

Our results are qualitatively similar without matching for observable characteristics (Table A.9). As we expect, given the nature of the selection of filings, the differences without matching are smaller than the differences with matching. Nevertheless, we still find a large relative difference of 31.3% for positive news and 68.0% for negative news close to open. These then diminish over time, with 3.3% (positive) and 3.5% (negative) left after five days. Statistically, the differences for positive news are not significant; those for negative news are, for the first three days.

To see whether the greater price formation after pre-cutoff filings is due to OTC trading before the release of post-cutoff filings, we reproduce the results of Table 6 but on the subsample of years for which we have OTC data in Table A.10. We include the price convergence of the stocks between filing and release of

[18] We reweight the post-5:30pm sample to match the first, second, and third moments of the following variables: 10-day returns, Fog, number of items, length of the filing, day of the week, year, filing item, Fama-French 49 industry classification, fraction of institutional ownership, and number of analysts across both subsamples. The reweighting procedure produces a well-balanced control group (Table A.8).

overnight news at 6.00am. The results from market opening are qualitatively unchanged from those in Table 6. The results on OTC trading are as follows: first, news filed between 5:00 pm and 6:00 pm do not exhibit any price pattern before 6:00 am, regardless of whether they are positive or negative. This is consistent with them not being released until 6:00 am, and with the absence of any other forms of leakage for these news items. Positive news released between 4:30 and 5:30 pm exhibits some positive returns (0.013%), but these are small relative to the 0.078% average return at opening. This indicates that the difference in price convergence between pre-threshold and post-threshold filings is not driven by the extra hours of OTC trading available to the pre-threshold filings. For the negative news filed between 4:30 and 5:30 pm, average returns by 6:00 am are statistically and economically insignificant. Taken together, the results in Table A11 indicate that our results in this section are not driven by differentials in OTC trading before 6:00 am.

Overall, our evidence shows that prices after filings before 5:30 pm, despite them being more complex, converge faster to their final price. This indicates a positive causal effect of attention on price formation. This is consistent with our interpretation that firms target their more complex news to periods when higher attention may provide better price formation.

6.3 Speed of price formation by complexity

We have shown above that stock prices after pre-cutoff filings converge faster than stock prices after post-cutoff filings. This response benefits news that are prone to messier price convergence, thus explaining our main finding that firms sort more complex news to the more attentive pre-cutoff period. In this section, we show explicitly that prices do converge faster for that type of complex news.

To do so, we repeat the above analysis for subsamples of more vs. less complex news. We classify a filing as "more complex" if its readability, length, and number of items are all above the median. This yields 7,288 "more complex" positive news and 7,384 negative ones, compared to 14,860 "less complex" positive news and 15,577 negative ones. We report the results in Tables A.11 and A.12; in Table 7, we show a summary of the differences between pre-cutoff and post-cutoff filings.

Panel A reports the results for positive news. The difference in price convergence is indeed more pronounced for more complex news, with a difference of 49.1% at the first opening price and 37.8% after the first trading day. In fact, the difference is statistically significant only for more complex news, with little difference for non-complex news. Panel B reports the results for negative news. Again, the convergence difference is more pronounced for more complex news, with a 73.8% difference at the first opening price and 30.1% after the first trading day (compared to 64.7% and 24.3% for non-complex news). For negative news, the differences are statistically significant for both more and less complex news.

Overall, our price convergence results suggest that attention targeting matters. News receives more attention at high-attention periods (pre-cutoff), and prices converge faster subsequently, especially for more complex news which normally take longer to understand and interpret. This establishes incentives for firms to file more complex news at times of high expected attention to improve liquidity and reduce adverse selection.

6.4 Liquidity

To study effects of timing complex news on adverse selection more directly, we study the stock liquidity of the filing firms. We do so by comparing different measures of volume and liquidity on the day after filing for firms in the high-attention regime and for firms in the low-attention regime. The results are shown in Table 8.

Panel A of Table 8 shows an RD estimate using our main specification, as in the rest of the paper. The results show that pre-cutoff filings exhibit a higher volume of trading both in dollar terms and in terms of the number of trades (Panel A, Columns 1–4) and lower spreads (Columns 5–6). There are no significant differences in idiosyncratic volatility (Column t).

In Panel B, we compare the mean of the variables over long intervals before and after the discontinuity, as in the price formation tests (4:30 pm–5:29 pm and 5:30 pm–6:00 am). We match the observations using the same criteria as in Table 6. The results show higher trading volume for the pre-cutoff filings. The differences are not significant in terms of spreads. To test whether liquidity is higher for the filings just pre-cutoff compared to those post-cutoff, we narrow the window of pre-cutoff filings in Panel C to those after 5:15 pm. These indeed exhibit a more pronounced difference for trading volumes and show a significantly smaller idiosyncratic volatility for pre-cutoff filings.

The results in Table 8 reinforce those in Tables 6 and 7 and show that filings pre-cutoff exhibit better price convergence and more liquidity.

7. Robustness

We provide auxiliary tests in this section. We show that the changes at 5:30 pm are absent for filings in a similar setting, but without scope for attention management. We then discuss the role of attention management in stale news, and finally show that our results are robust to excluding the filing item “other events”.

7.1 Placebo test for attention: Form 4 filings

Unlike 8-K filings, Form 4 filings (insider trading) receive a same-day timestamp up until 10:00 pm and immediately become publicly visible, even after 5:30 pm. Therefore, they should not exhibit any abnormal patterns in investor attention at 5:30 pm, unless the discontinuity in 8-K filings is due to other institutional determinants. In Figure A.2, we plot the number of filings and the number of downloads per filing. The number of filings is stable before 5:00 pm and drops continuously afterward, and later filings are downloaded more often. Neither number exhibits sharp discontinuities at 5:30 pm. The absence of Form 4 discontinuities suggests there are no other institutional changes in investor attention at 5:30 pm that drive our results. In addition, they suggest that the surge in complex news just before the cutoff does not crowd out investor attention in general – at least not enough to affect attention paid to Form 4 filings.

7.2 Placebo test for complexity: Amendments

Amendment filings repeat an entire previous filing, but for some amended information. Because most information has been previously released, textual and other complexity-related measures do not capture the novel content of the amendment filings. Thus, amendments should not raise the same concerns. In Table A.13 (Panel A), we report a "placebo" test using only amendments (8-K/A). Amendments do not exhibit any of the patterns documented earlier.

7.3 Stale news

Firms can release the same information through multiple venues – for example, websites, social media, or press releases (Campbell, Twedt, and Whipple, 2019). Such releases enable investors to access information via the press, rendering the 5:30 pm cutoff less relevant for information availability. Indeed, Ma (2015) shows that EDGAR search volumes are lower for filings that have simultaneous press releases.

In Table A.13 (Panel B), we report our key tests for filings with press releases via newswires (PR or JCN) on the same or the next day after filing. Our results hold for filings without press releases, but not for those with press releases. Releasing press releases would not be consistent with timing the news post-cutoff with the objective of minimizing attention. Consistent with this argument, there is a significantly higher density of filings with press releases pre-cutoff vs. post-cutoff (0.52% vs. 0.30%).

Even in the absence of deliberate news releases, information about an event can leak before the filing. Indeed, Lerman and Livnat (2010) and Cohen, Jackson, and Mitts (2015) report significant abnormal trading volumes between event and filing dates for most 8-K filings. Callen, Kaniel, and Segal (2019) show that a significant fraction of that volume stems from institutional investors who trade based on the leaked sign of the news. This trading strategy is more likely for filings with a greater lag between event and release.

In Table A.13 (Panel C), we compare the results for our key tests between filings with a minimal lag (on the event date and the calendar day after) and those with a long lag (more than five calendar days after the event date). We still exclude deadlines and late filings: five calendar days can be within that sample when weekends and bank holidays follow the event, or for deadline-exempt filings such as the "other" category. Firms with a five-day lag or higher represent 5% of the after-hours news sample. The large discontinuous drop in filing complexity around the cutoff at 5:30 pm is significant for both subsamples for the number of items and for filing length. This suggests that filings contain relevant information even if the reported event itself was known before; this is consistent with Lerman and Livnat (2010). In long-lag filings, the around-cutoff drop is not significant for language complexity, as measured by Fog. This may reflect firms using the long lag for improving the clarity of the filing, as suggested by Callen, Kaniel, and Segal (2019).

7.4 Excluding "other events"

"Other events" (currently items in Section 8) are voluntary disclosures (e.g., Lerman and Livnat, 2010). Thus, it is unclear whether they have the same deadline requirements, although many of them may simply have been misclassified (Bird, Karolyi, and Ma, 2018). In Table A.13 (Panel D), we report our key results excluding "other events" filings. The results are qualitatively unchanged.

8. Conclusions

We use the strategic timing of corporate news to study how firms target the release of their more complex news to periods with higher investor attention. A discontinuity in the SEC filing platform allows us to distinguish regimes in investor attention that affect news releases. Attention is significantly lower for filings that are stored on the server and released simultaneously with many others, even if firms filed them just after the filing platform closes. Firms strategically match information to the attention regimes: they are more likely to disclose difficult-to-process news in the high-attention regime just before filing system closure than right afterward. This behavior enables investors to investigate the content of the information more extensively before the next opportunity to trade, and is consistent with firms trying to reduce adverse selection when investors have heterogeneous ability to process news in the short term. Subsequent price convergence is faster for filings released during the high-attention period, indicating that investors take advantage of its more generous reading time.

This paper provides evidence for the use of cooperative attention management in news releases and contrasts with a large body of literature on the obfuscation of bad news. Matching complex news to investor attention improves price formation and liquidity, and therefore firm value. Our results show that firms take

this argument into account and actively match the release of complex news to times of higher expected investor attention. In fact, these two disclosure strategies can co-exist and are, to some extent, complements, as obfuscation is more likely to succeed against a more cooperative and transparent disclosure history.

In the wake of the recent rise of algorithmic trading, one may be concerned that humans will no longer be needed in information processing. Our results suggest that this is not the case, at least not in the context of corporate news. Firms explicitly cater to human processing constraints by releasing news at peak capacity. One interpretation of such strategic attention targeting is that, for more complex news specifically, firms prefer humans to read some of their news first before the machines begin to trade on it.

Trading and information processing technologies have developed dramatically over recent years. Our results represent one step in the academic research conducted to understand attention patterns at a relatively high frequency (intraday). In our paper, the institutional setting creates a specific context that is convenient for empirical analysis. Our paper showcases how details in technology and institutional settings can alter the information environment. While our results may be a reflection of a broader phenomenon, it remains a question for further research whether this link applies to other types of filings, filing periods, or contexts. Other senders and recipients of information often take decisions similar to the ones that firms and investors take in our context. Related contexts include the information exchange between political parties and voters, between policy makers and the general public, and between firms and consumers. How coordination in terms of information timing plays out in these information markets remains an open question.

REFERENCES

Ahern, K. R., Sosyura, D., 2014. Who writes the news? Corporate press releases during merger negotiations, *Journal of Finance* 69, 241–291.

Alleen, K. D., DeAngelis, M. D., Moon Jr., J. R., 2018. Disclosure "scriptability", *Journal of Accounting Research* 56, 363–430.

Amihud, Y., 2002. Illiquidity and stock returns: Cross-section and time-series effects, *Journal of Financial Markets* 5, 31–56.

Bagnoli, M. E., Clement, M. B., Watts, S. G., 2006. Around-the-clock media coverage and the timing of Earnings Announcements, McCombs Research Paper Series No. ACC-02-06.

Balakrishnan, K., Billings, M., Kelly, B., Ljungqvist, A., 2014. Shaping liquidity: On the causal effects of voluntary disclosure, *Journal of Finance* 69, 2237–2278.

Barclay, M. J., Hendershott, T., 2003. Price discovery and trading after hours, *Review of Financial Studies* 16, 1041–1073.

Baron, M., Brogaard, J., Hagströmer, B., Kirilenko, A., 2019. Risk and return in high-frequency trading, *Journal of Financial and Quantitative Analysis* 54, 993–1024.

Barry, C. B., Brown, S. J., 1985. Differential information and security market equilibrium, *Journal of Financial and Quantitative Analysis* 20, 407–422.

Bauguess, S. W., Cooney, J. W., Hanley, K. W., 2018. Investor demand for information in newly issued securities. Unpublished working paper.

Ben-Rephael, A., Da, Z., Israelsen, R.D., 2017. It depends on where you search: Institutional investor attention and underreaction to news, *Review of Financial Studies* 30, 3009–3047.

Biais, B., Foucault, T., Moinas, S., 2015. Equilibrium fast trading, *Journal of Financial Economics* 116, 292–313.

Bird, A., S. Karolyi, P. Ma, 2018. Strategic disclosure misclassification. Unpublished working paper.

Blankespoor, E., 2019. The impact of information processing costs on firm disclosure choice: Evidence from the XBRL mandate, *Journal of Accounting Research* 57, 919–967.

Blankespoor, E., DeHaan, E., Marinovic, I., 2020. Disclosure processing costs, investors' information choice, and equity market outcomes: A review, *Journal of Accounting and Economics* 70.

Boguth, O., Grégoire, V., Martineau, C., 2018. Shaping expectations and coordinating attention: The unintended consequences of FOMC press conferences, *Journal of Financial and Quantitative Analysis* 54, 2327–2353.

Bolandnazar, M., Jackson, R. J., Jiang, W., Mitts, J., 2020. Trading against the random expiration of private information: A natural experiment, *Journal of Finance* 75, 5–44.

Boulland, R., Dessaint, O., 2017. Announcing the announcement, *Journal of Banking and Finance* 82, 59–79.

Brogaard, J., Hendershott, T., Riordan. R., 2014. High-frequency trading and price discovery, *Review of Financial Studies* 27, 2267–306.

Callen, J. L., Kaniel, R., Segal, D., 2021. DP16476 Filing speed, information leakage, and price formation. CEPR Press Discussion Paper No. 16476.

Calonico, S., Cattaneo, M., Titinuik, R., 2014. Robust nonparametric confidence intervals for regression-discontinuity designs, *Econometrica* 82, 2295–2326.

Calonico, S., Cattaneo, M. D., Farrell, M. H., 2020. Optimal bandwidth choice for robust bias corrected inference in regression discontinuity designs, *Econometrics Journal* 23, 192–210.

Cao, S., Jiang, W., Yang, B., Zhang., A., 2021. How to talk when a machine is listening: Corporate disclosure in the age of AI. Unpublished working paper, National Bureau of Economic Research.

Cattaneo, M. D., Jansson, M, Ma, X., 2018. Manipulation testing based on density discontinuity. *Stata Journal* 18, 234–261.

Chapman, K. L., Reiter, N., White, H. D., Williams, C. D., 2019. Information overload and disclosure smoothing, *Review of Accounting Studies* 24, 1486–1522.

Cliff, M., Cooper, M. J., Gulen, H., 2008. Return differences between trading and non-trading hours: Like night and day. Unpublished working paper, University of Utah.

Chakrabarty, B., Moulton, P. C., Wang, X. F., 2015. Attention effects in a high-frequency world. SHA Working Papers

Chen, H., Cohen, L., Gurun, U., Lou, D., Malloy, C., 2020. IQ from IP: simplifying search in portfolio choice, *Journal of Financial Economics* 138, 118–137.

Chen, J., Demers, E., Lev, B., 2018. Oh what a beautiful morning! Diurnal influences on executives and analysts: Evidence from conference calls, *Management Science* 64, 5899–5924.

Cohen, A., Jackson, R. J. Jr., Mitts, J. R., 2015. The 8-K trading gap. Working paper, Harvard Law School.

Cohn, J., Gurun, U., Moussawi, R., 2019. A project-level analysis of value creation in firms, *Financial Management* 49, 1–24.

Coles, J. L., Loewenstein, U., 1988. Equilibrium pricing and portfolio composition in the presence of uncertain parameters, *Journal of Financial Economics* 22, 279–303.

Couttenier, M., Hatte, S., 2016. Mass media effects on non-governmental organizations, *Journal of Development Economics* 123, 57–72.

Crane, A., Crotty, K., Umar, T., 2022. Hedge funds and public information acquisition, *Management Science*, forthcoming.

Crego, J., 2020. Why does public news augment information asymmetries? *Journal of Financial Economics* 137, 72–89.

Daniel, K., Hirshleifer, D., Teoh, S., 2002. Investor psychology in capital markets: Evidence and policy implications, *Journal of Monetary Economics* 49, 139–209.

Davies, S. W., 2015. Retail traders and the competitive allocation of attention. Unpublished working paper.

DeHaan, E., Shevlin, T. J., Thornock, J., 2015. Market (in)attention and the strategic scheduling and timing of earnings announcements, *Journal of Accounting and Economics* 60, 36–55.

Dellavigna, S., Pollet, J., 2009. Investor inattention and Friday earnings announcements, *Journal of Finance* 64, 709–749.

Di Maggio, M., Pagano, M., 2018. Financial disclosure and market transparency with costly information processing, *Review of Finance* 22, 117–153.

Diamond, D. W., 1985. Optimal release of information by firms, *Journal of Finance* 40, 1071–1094.

Diamond, D. W., Verrecchia, R. E., 1991. Disclosure, liquidity, and the cost of capital, *Journal of Finance* 46, 1325–1359.

Djourelova, M., Durante, R., 2021. Media attention and strategic timing in politics: Evidence from U.S. presidential orders. *American Journal of Political Science*, 66: 813-834.

Doyle, J. T., Magilke, M., 2009. The timing earnings announcements: An examination of the strategic disclosure hypothesis, *Accounting Review* 84, 157–182.

Dontoh, A., Ronen, J., 1993. Information content of accounting announcements, *Accounting Review* 68, 857–869.

Drake, M. S., Roulstone, D. T., Thornock, J. R., 2015. The determinants and consequences of information acquisition via EDGAR, *Contemporary Accounting Research* 32, 1128–1161.

Drake, M. S., Roulstone, D. T., Thornock, J. R., 2016. The usefulness of historical accounting reports, *Journal of Accounting and Economics* 61, 448–464.

Edmans, A., Goncalves-Pinto, L., Groen-Xu, M., Wang, Y., 2018. Strategic news releases in equity vesting months, *Review of Financial Studies* 31, 4099–4141.

Easley, D., O'Hara, M., 2004. Information and the cost of capital, *Journal of Finance* 59, 1553–1583.

Engelberg, J., 2008. Costly information processing: Evidence from earnings announcements. Unpublished working paper.

Fedyk, A., 2020. Disagreement after news: Gradual information diffusion or differences in opinion? *Review of Asset Pricing Studies*, forthcoming.

Fedyk, A., 2021. Front page news: The effect of news positioning on financial markets. Unpublished working paper.

Foucault, T., Hombert, J., Roşu, I., 2016. News trading and speed, *Journal of Finance* 71, 335–82.

Francis, J., Pagach, D., Stephan, J., 1992. The stock market response to earnings announcements released during trading versus nontrading periods, *Journal of Accounting Research* 30, 165–184.

Gennotte, G., Trueman, B., 1996. The strategic timing of corporate disclosures, *Review of Financial Studies* 9, 665–690.

Gregoire, V., Martineau, C., 2021. How is earnings news transmitted to stock prices? *Journal of Accounting Research* 60, 261–297.

Griffin, P. A., 2003. Got information? Investor response to form 10-K and form 10-Q EDGAR filings, *Review of Accounting Studies* 8, 433–460.

Guay, W., Samuels, D., Taylor, D., 2016. Guiding through the fog: Financial statement complexity and voluntary disclosure, *Journal of Accounting and Economics* 62, 234–269.

Guest, N. M., 2021. The information role of the media in earnings news, *Journal of Accounting Research* 59, 1021–1076.

Gunning, R., 1952. *The Technique of Clear Writing*, McGraw-Hill, New York.

Hendershott, T., Jones, C. M., Menkveld. A. J., 2011. Does algorithmic trading improve liquidity? *Journal of Finance* 66, 1–33.

Hirshleifer, D., Lim, S., Teoh, S., 2009. Driven to distraction: Extraneous events and underreaction to earnings news. *Journal of Finance* 64, 2289–2325.

Hirshleifer, D., Lim, S., Teoh, S., 2011. Limited investor attention and stock market misreactions to accounting information, *Review of Asset Pricing Studies* 1, 35–73.

Hirshleifer, D., Teoh, S., 2003. Limited attention, information disclosure, and financial reporting, *Journal of Accounting and Economics* 36, 337–386.

Iliev, P., Kalodimos, J., Lowry, M., 2021. Investors' Attention to Corporate Governance, *Review of Financial Studies* 34, 5581–5628.

Imbens, G., Lemieux, T., 2008. Regression discontinuity designs: A guide to practice, *Journal of Econometrics* 142, 615–635.

Jiang, C. X., Likitapiwat, T., McInish, T. H., 2012. Information content of earnings announcement: Evidence from after-hours trading, *Journal of Financial and Quantitative Analysis* 47, 1303–1330.

Jin, G. Z., Luca, M., Martin, D., 2022. Complex disclosure, *Management Science* 68, 3236–3261.

Klein, R. W., Bawa, V. S., 1976. The effect of estimation risk on optimal portfolio choice, *Journal of Financial Economics* 3, 215–231.

Kleven, H., 2016. Bunching, *Annual Review of Economics* 8, 435–464.

Kim, O., Verrecchia, R. E., 1991. Market reaction to anticipated announcements, *Journal of Financial Economics* 30, 273–309.

Kim, O., Verrecchia, R. E., 1994. Market liquidity and volume around earnings announcements, *Journal of Accounting and Economics* 17, 41–67.

Kim, O., Verrecchia, R. E., 1997. Pre-announcement and event-period private information, *Journal of Accounting and Economics* 24, 395–419.

Kraft, P., Xie, Y., Zhou, L., 2020. The intraday timing of rating changes, *Journal of Corporate Finance,* forthcoming.

Lee, C. M., Ma, P., Wang, C., 2015. Search-based peer firms: Aggregating investor perception through internet co-searches, *Journal of Financial Economics* 116, 410–431.

Lee, D., 2008. Randomized experiments from nonrandom selection in U.S. house elections, *Journal of Econometrics* 142, 675–97.

Lee, D., Lemieux, T., 2010. Regression discontinuity designs in economics, *Journal of Economic Literature* 48, 281–355.

Lee, C. M., Ready, M. J., 1991. Inferring trade direction from intraday data, *Journal of Finance* 46, 733–746.

Lerman, A., Livnat, J., 2010. The new form 8-K disclosures, *Review of Accounting Studies* 15, 752–778.

Li, F., 2008. Annual report readability, current earnings, and earnings persistence, *Journal of Accounting and Economics* 45, 221– 47.

Li, J., 2016. Slow price adjustment to public news in after-hours trading, *Journal of Trading* 11, 16–31.

Libby, R., Bloomfield, R., Nelson, M., 2002. Experimental research in financial accounting, *Accounting, Organizations and Society* 27, 775–810.

Lou, D., 2014. Attracting investor attention through advertising, *Review of Financial Studies* 27, 1979–1829.

Lou, D., Polk, C., Skouras, S., 2019. A tug of war: Overnight versus intraday expected returns, *Journal of Financial Economics* 134, 192–213.

Loughran, T., McDonald, B., 2011. When is a liability not a liability? Textual analysis, dictionaries, and 10-Ks, *Journal of Finance* 66, 35–65.

Loughran, T., McDonald, B., 2014. Measuring readability in financial disclosures, *Journal of Finance* 69, 1643–1671.

Lundholm, R J., Rogo, R., Zhang, J. L., 2014. Restoring the Tower of Babel: How foreign firms communicate with U.S. investors, *Accounting Review* 89, 1453–1485.

Ma, P., 2015. Information or spin? Evidence from language differences between 8-Ks and press releases. Unpublished working paper.

Maines, L., 1995. Judgment and decision-making research in financial accounting: a review and analysis, *Cambridge Series on Judgment and Decision Making*, 76–101.

Martineau, C., 2021. Rest in peace post-earnings announcement drift, *Critical Finance Review,* Vol. 11: No. 3-4, pp 613-646.

Michaely, R., Rubin, A., Vedrashko, A., 2014. Corporate governance and the timing of earnings announcements, *Review of Finance* 18, 2003–2044.

Michaely, R., Rubin, A., Vedrashko, A., 2016a. Are Friday announcements special? Overcoming selection bias, *Journal of Financial Economics* 122, 65–85.

Michaely, R., Rubin, A., Vedrashko, A., 2016b. Further evidence on the strategic timing of earnings news: Joint analysis of weekdays and times of day, *Journal of Accounting and Economics* 62, 24–45.

Miller, B. P., 2010. The effects of reporting complexity on small and large investor trading, *Accounting Review* 85, 2107–2143.

Niessner, M., 2015. Strategic disclosure timing and insider trading. *CGN: Insider Trading (Topic).* Unpublished working paper, Yale School of Management.

Pagano, M., Röell, A., 1996. Transparency and liquidity: A comparison of auction and dealer markets with informed trading, *Journal of Finance* 51, 579–611.

Pagano, M., Volpin, P., 2012. Securitization, transparency, and liquidity, *Review of Financial Studies* 25, 2417–2453.

Pashler, H., Johnston, J., James, C., 1998. Attentional limitations in dual-task performance, in H. Pashler (ed.), *Attention*, Hove, U.K., 155–189.

Patell, J. M., Wolfson, M., 1982. Good news, bad news, and the intraday timing of corporate disclosures, *Accounting Review* 57, 509–527.

Pavan, A., 2016. Attention, coordination, and bounded recall. Unpublished working paper, Northwestern University.

Peng, L., Xiong, W., 2006. Investor attention, overconfidence and category learning, *Journal of Financial Economics* 80, 563–602.

Peress, J., Schmidt, D., 2019. Glued to the TV: Distracted noise traders and stock market liquidity, *Journal of Finance* 75, 1083–1133.

Plumlee, M., 2003. The effect of information complexity on analysts' use of that information, *Accounting Review* 78, 275–296.

Pungaliya, R. S., Wang, Y., 2018. Machine invasion: Automation in information processing and the cross section of stock returns. Unpublished working paper.

Rogers, J. L., Skinner, D., Zechman, S. L. C., 2017. Run EDGAR run: SEC dissemination in a high-frequency world, *Journal of Accounting Research* 55, 459–505.

Segal, B., Segal, D., 2016. Are managers strategic in reporting non-earnings news? Evidence on timing and news bundling, *Review of Accounting Studies* 21, 1203–1244.

Shapiro, A., 2002. The investor recognition hypothesis in a dynamic general equilibrium: Theory and evidence, *Review of Financial Studies* 15, 97–141.

Sims, C., 2003. Implications of rational inattention, *Journal of Monetary Economics* 50, 665–690.

Sims, C., 2006. Rational inattention: Beyond the linear-quadratic case, *American Economic Review* 96, 158–163.

Van Nieuwerburgh, S., Veldkamp, L., 2009. Information immobility and the home bias puzzle, *Journal of Finance* 64, 1187–1215.

Van Nieuwerburgh, S., Veldkamp, L., 2010. Information acquisition and under-diversification, *Review of Economic Studies* 77, 779–805.

Weller, B. M., 2018. Does algorithmic trading reduce information acquisition? *Review of Financial Studies* 31, 2184–2226

Yang, L., Zhu, H., 2020. Back-running: Seeking and hiding fundamental information in order flows, *The Review of Financial Studies* 33(4), 1484–1533.

Yantis, S., 1998. Control of visual attention, *Attention* 1, 223–256.

Zhang, S., 2018. Need for speed: Hard information processing in a high-frequency world. *Journal of Futures Markets* 38, 3–21.

Zhang, X. F., 2006. Information uncertainty and stock returns, *Journal of Finance* 61, 105–137.

Figure 1. Filing volume by time of day

This figure shows the aggregate number of 8-K filings filed between September 2004 and March 2012, excluding on-deadline and post-deadline filings, bankruptcies, and earnings announcements, ordered by the hour of their public appearance on EDGAR. For the number of filings, the solid line indicates the hour when filings become publicly available, which coincides with the acceptance hour for all filings before 5:30 pm. The dashed line indicates the hour of acceptance for after-hour filings that become public only after a delay at 6:00 am. The vertical black line indicates the cutoff at 5:30 pm, and the light blue shade indicates the focus of our analysis (4:30pm–6:00 am).

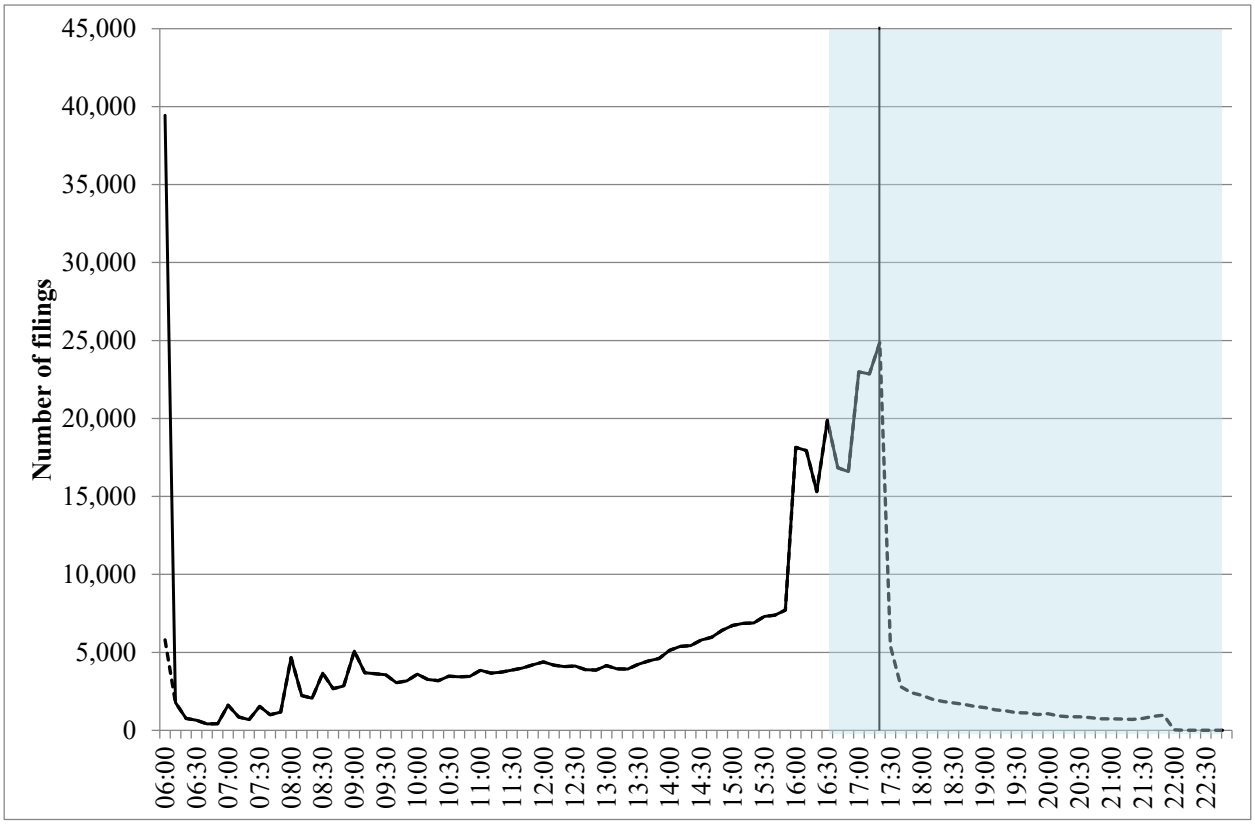
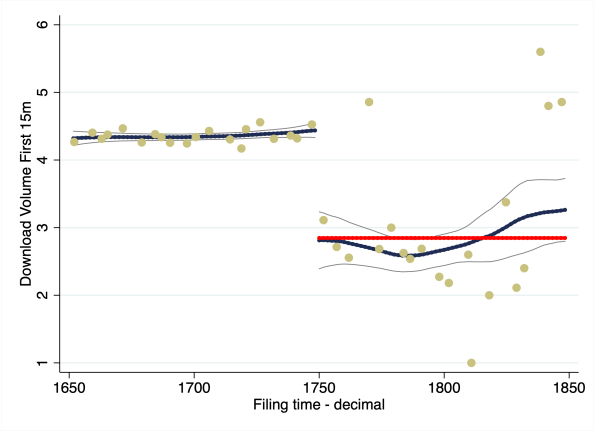


Figure 2. Download volume for filings around the cutoff

This figure shows local linear regressions with 10% confidence intervals and a bandwidth of 30 minutes, allowing for discrete jumps at 5:30, and with triangular weighting. The dependent variable is the number of downloads per filing accumulated from becoming visible. Panel A shows the first 5 minutes, Panel B the first 5 minutes including automated downloads, Panel C the time until the market opening, and Panel D the first 24 hours after publication. Panels A, C, and D are constructed excluding automatic downloads. Filings from 5:30 to 5:34 pm are excluded. Dots represent averages of the dependent variable on three-minute bins. A right-hand-side horizontal line depicts the mean of the dependent variable between 5:35 pm and 5:59 am.

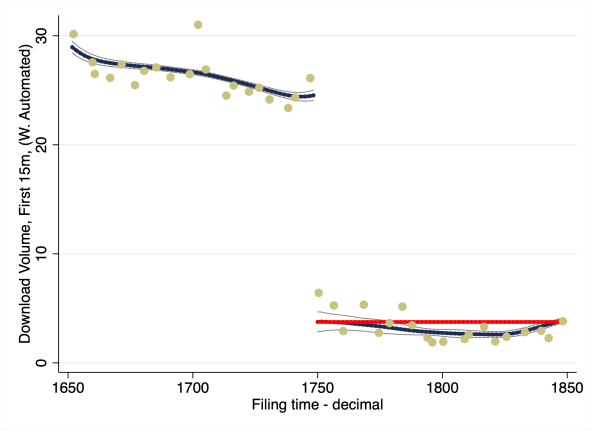
Panel A

Download volume, first 5 minutes



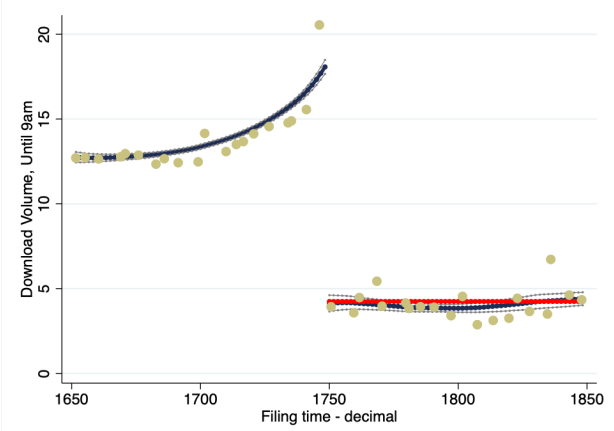
Panel B

Download volume, first 5 minutes including automated downloads



Panel C

Download volume, from filing until 9:30 am



Panel D

Download volume, first 24h

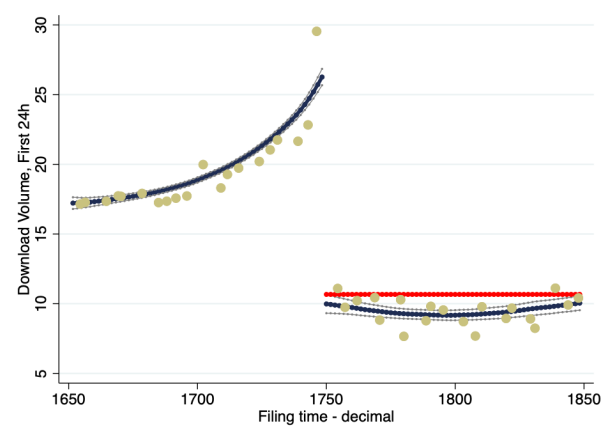
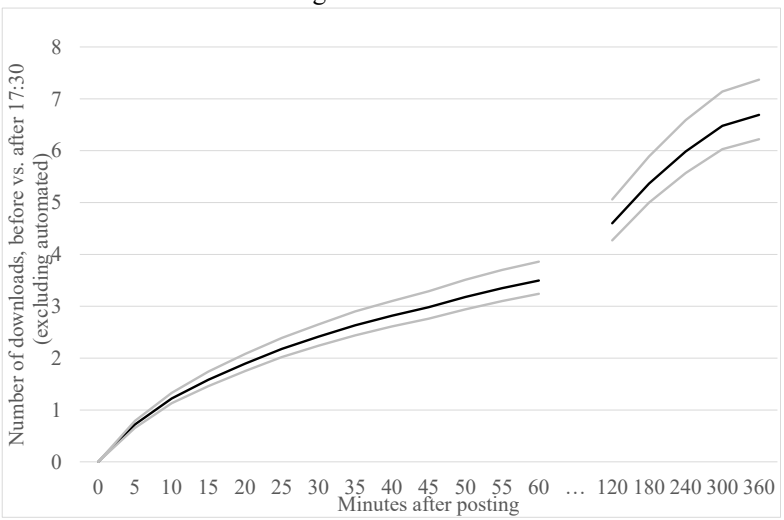


Figure 3. Difference in download volume over time – pre-5:30 minus post-5:30 pm filings

This figure shows coefficient estimates for the difference in downloads per filing at the cutoff (pre-5:30 minus post-5:30 pm), where download numbers are counted for the number of minutes given by the x-axis (five-minute intervals in the first hour, and one-hour intervals afterward) at different time horizons. Estimates use two-sided local linear regressions with an optimal bandwidth defined as in Calonico, Cattaneo, and Farrell (2020), with 10% confidence intervals, as shown in Table 2, Panel A, column 1. The dependent variable is the number of downloads accumulated from becoming visible, where downloads in Panel A exclude automated downloads. Filings from 5:30 to 5:34 pm are excluded.

Panel A

Excluding automated downloads



Panel B

Including automated downloads

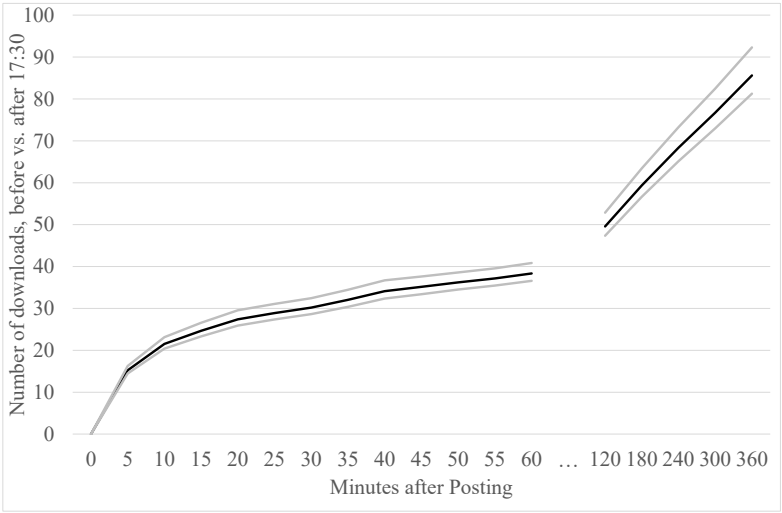


Figure 4. Time of download

This figure shows the mean number of downloads per hour (of download), where the time of filings is indicted by the color (black for 4:30–5:30 pm, and blue for 5:35 pm–6:00 am overnight filings). Solid lines mark download numbers, including automated downloads; dashed lines exclude automated downloads. Filings from 5:30 to 5:34 pm are excluded.

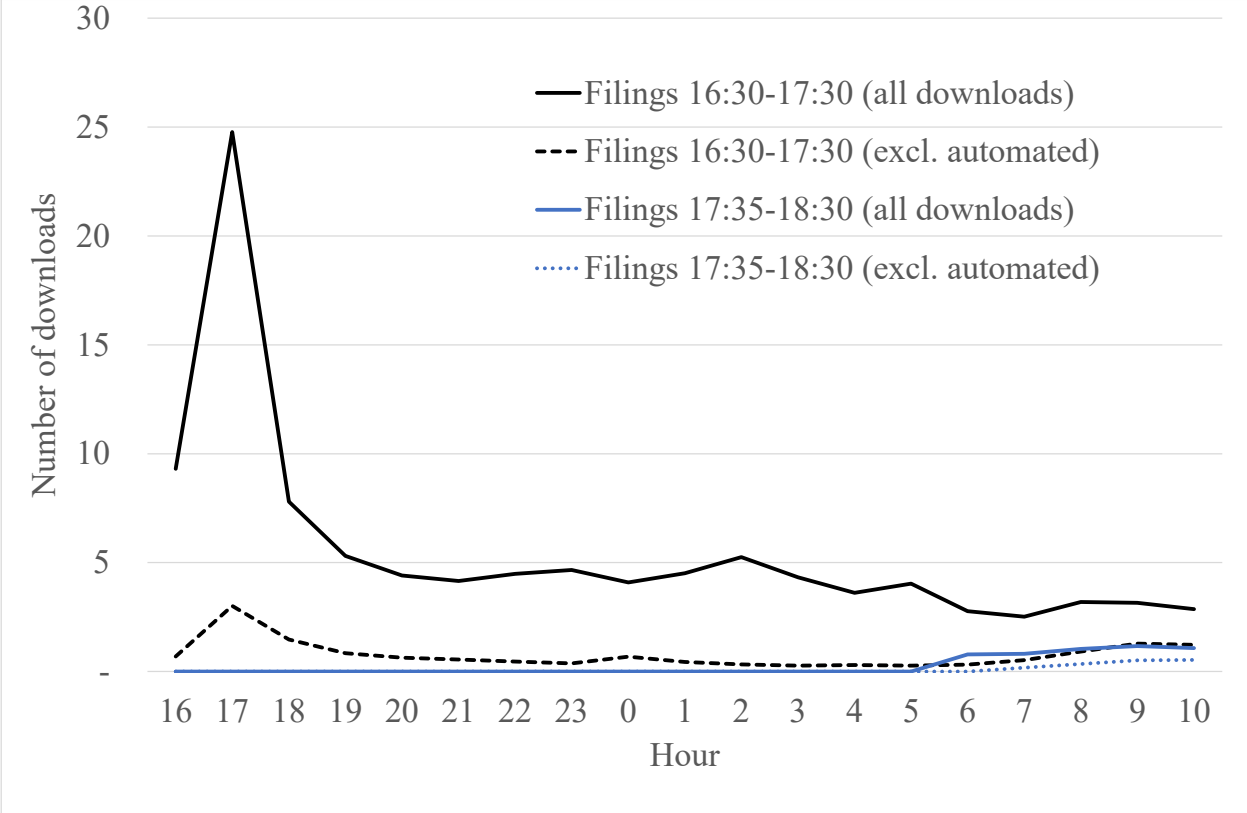


Figure 5. Download volume vs. volume of simultaneous filings

This figure shows the number of downloads in the first five minutes per filing on the y-axis and the number of filings in the same five-minute bracket, measured as a percentile of all filings, on the x-axis. The sample excludes overnight filings from 5:30 pm to 5:59 am (270 simultaneous filings, on average, above the maximum number of filings in all other five-minute-brackets).

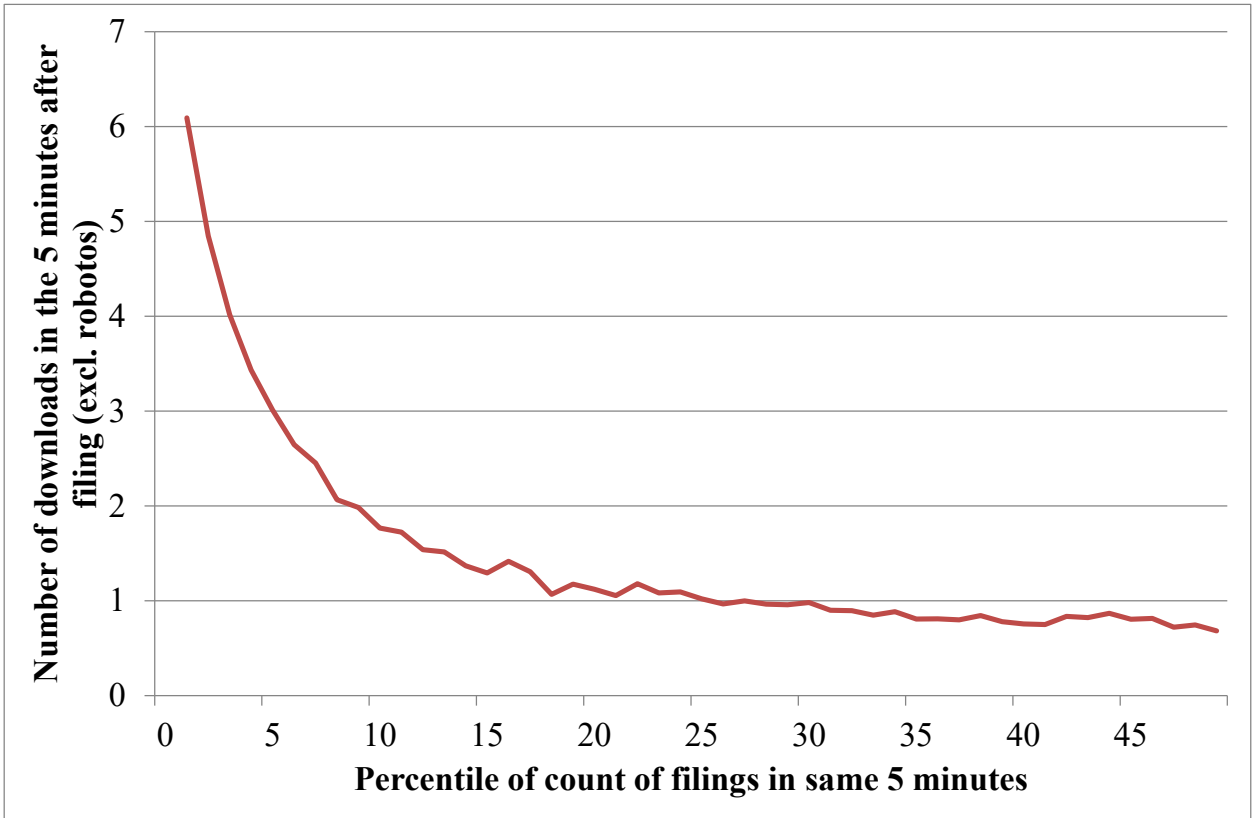


Figure 6. Complexity around the cutoff

This figure shows local linear regressions with 10% confidence intervals and a bandwidth of 30 minutes, allowing for discrete jumps at 5:30 pm and with triangular weighting. The dependent variables are, in Panel A: "# Items," the number of different items filed within one filing; in Panel B: "Fog," the Fog index of text readability; in Panel C (D): "Length," the word count per attachment (of all documents) in the filing. Filings from 5:30 to 5:34 pm are excluded. Dots represent the averages of the dependent variable on three-minute bins. A right-hand-side horizontal line depicts the mean of the dependent variable between 5:35 pm and 5:59 am.

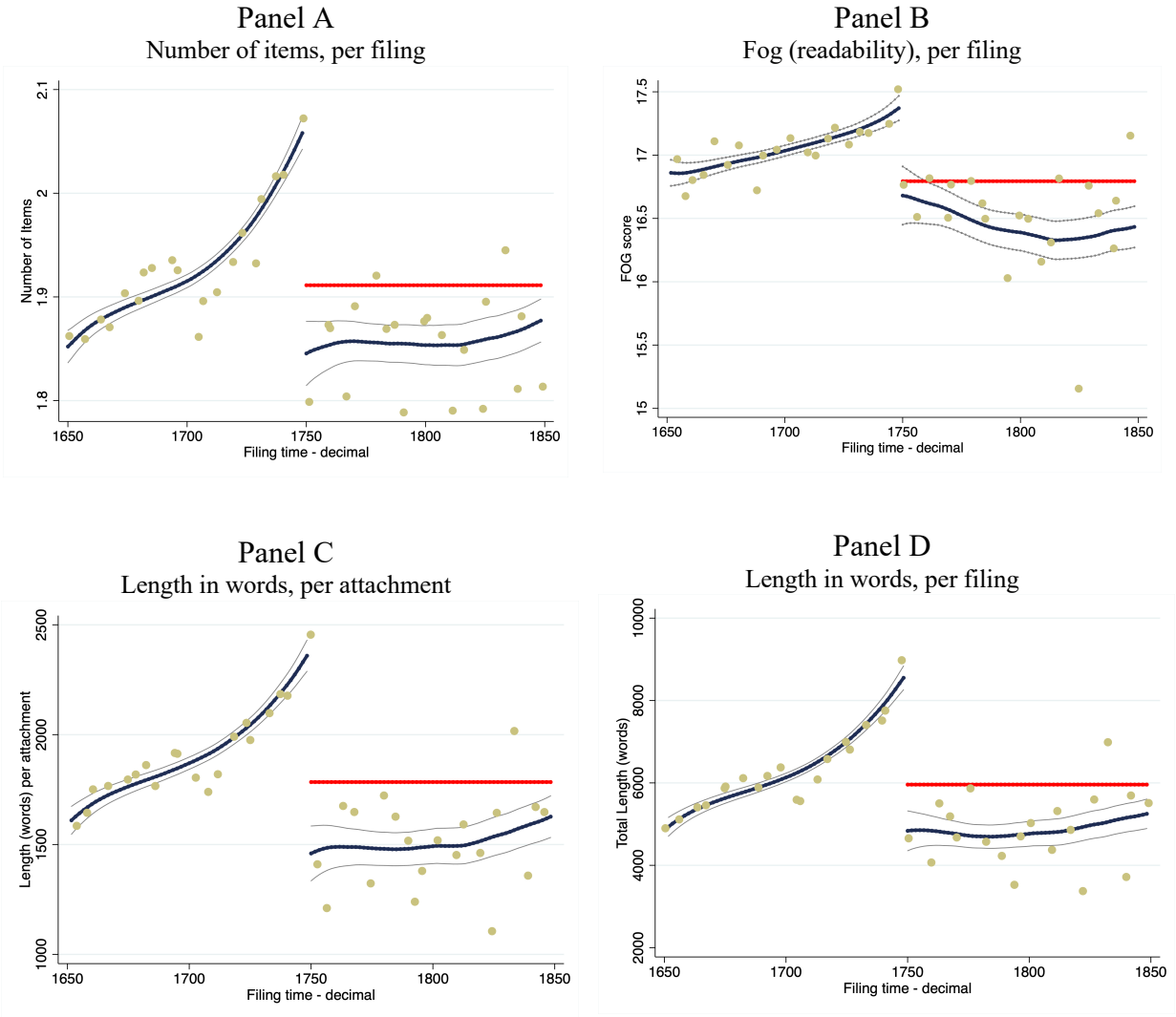


TABLE 1

Descriptive statistics

Panel A displays the frequency of mandatory 8-K filings and the number of downloads per filing in the first 24 hours after the 8-K becomes public. Data comprise all 8-K filings from September 2004 until March 2012, except for filings on or after the deadline, and bankruptcy and earnings announcements. Panel B describes the sample. Filing length is the number of words in a filing. Fog is 0.4*(average number of words per sentence + percent of words with more than two syllables). Downloads are the number of downloads (including and excluding automated downloads) in the first 24 hours after publication, unless otherwise specified. Number of trades, spreads, and idiosyncratic volatility are for the second day of trading. The number of observations may change due to missing values.

Panel A: Number of observations by year

Year	(1) Number of filings	(2) Download volume, excluding automated	(3) Download volume, including automated
2004	5,999	10.76	57.21
2005	32,202	6.80	26.77
2006	36,115	4.62	15.24
2007	34,548	9.49	32.94
2008	31,730	14.09	43.76
2009	28,842	24.19	131.49
2010	28,269	29.37	191.94
2011	27,490	32.07	214.14
2012	7,700	34.36	249.17
Total	232,895	16.75	91.48

Panel B: Summary statistics

Variable	(1) Mean	(2) Median	(3) Std. dev.	(4) 10th per.	(5) 90th per.
Number of items	1.902	2	0.868	1	3
Filing length: total number of words	5,956.404	740	23,420.630	36	13,401
Filing length: average per attachment	1,776.114	426	4,325.082	36	4,227.667
Fog: average	16.787	17	5.434	0	23
First 5 minutes downloads, excl. robots	1	0	3.621149	0	4
First 5 minutes downloads, all	16	6	23.182	0	50
Downloads: excluding automated	16.745	8	67.863	0	38
Downloads: including automated	91.483	40	197.583	1	208
Announcement returns: (-1,1) days	-0.001	-0.080	6.352	-6.282	6.282
Announcement returns: (-5,5) days	0.001	-0.140	11.000	-11.725	11.607
Trading volume	58.5 M	3,8 M	269.0 M	44,595	113.0 M
Number of trades	8,454	1,488	32,879	34	19,193
Buy volume	1,335,893	143,723	13,000,000	4,190	2,073,560
Sell volume	1,325,050	147,767	11,800,000	5,000	2,048,030
Realized spread	0.55773%	0.14137%	1.55377%	0.00960%	1.42410%
Quoted spread	0.84855%	0.22106%	2.70047%	0.04919%	2.06740%
Idiosyncratic volatility, quotes	0.00235%	0.00002%	0.09145%	0.00000%	0.00058%
Institutional ownership	0.375	0.258	0.378	0.000	0.952
Number of analysts	5	1	6	0	14

TABLE 2

Number of downloads per filing

Panel A shows estimates for the difference at cutoff (post-5:30 minus pre-5:30 pm) from local linear regressions with an optimal bandwidth defined as in Calonico, Cattaneo, and Farrell (2020). Panel B shows global regressions with time polynomials of order four to each side of the discontinuity, where *overnight* is an indicator variable for filings filed between 5:35 pm and 5:59 am. The dependent variable is the number of downloads in the timeframe given in the caption. Filings from 5:30 to 5:34 are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: At 5:30 pm

	(1)	(2)	(3)	(4)	(5)	(6)
Automated downloads:	No	Yes	No	Yes	No	Yes
Time	5 min.	5 min.	Until opening	Until opening	24 h	24 h
Post- minus pre-	-0.719	-15.23	-17.29	-148.3	-18.67	-161.1
p-value	0.000	0.000	0.000	0.000	0.000	0.000
Bandwidth (in % of h)	38.877	21.948	7.896	22.030	15.606	24.505
N pre	30761	18467	7034	18530	13598	20780
N post	3096	1910	742	1915	1389	2121

Panel B: All overnight

	(1)	(2)	(3)	(4)	(5)	(6)
Automated downloads:	No	Yes	No	Yes	No	Yes
Time	5 min.	5 min.	Until opening	Until opening	24 h	24 h
Overnight	-0.634***	-13.56***	-9.743***	-97.52***	-14.05***	-120.3***
	(0.0534)	(0.461)	(0.207)	(1.512)	(0.465)	(2.466)
N	231,861	231,861	231,861	231,861	231,861	231,861
R^2	0.142	0.055	0.219	0.223	0.074	0.059

TABLE 3

Number of contemporaneous downloads

This table shows OLS regressions for 8-Ks filed throughout the day. The dependent variable is the number of downloads per 8-K filing. *Overnight* is an indicator variable for filings filed between 5:35 pm and 5:59 am. *Log # other files* is the logarithm of the number of all filings filed in the same five minutes. Independent variables include year, month, day of the week, and firm fixed effects. Standard errors are clustered by firm-days. Filings from 5:30 to 5:34 are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Number of contemporaneous filings and number of downloads

Time period after posting	(1) 5 minutes, excl. automated	(2) 5 minutes, all	(3) 24 hours, excl. automated	(4) 24 hours, all
Overnight	-1.412***	-17.04***	-10.05***	-65.78***
	(0.0114)	(0.139)	(0.217)	(0.705)
Log # other files	-0.000157***	-0.000645***	-0.000232	-9.41e-05
	(9.02e-06)	(4.31e-05)	(0.000202)	(0.000496)
N	232,895	232,895	232,895	232,895
R^2	0.092	0.615	0.029	0.183

Panel B: Percentile of contemporaneous filings and number of downloads

Time periods after posting	(1) 5 minutes, excl. automated	(2) 5 minutes, all	(3) 24 hours, excl. automated	(4) 24 hours, all
Overnight	-1.461***	-16.89***	-10.49***	-66.93***
	(0.0126)	(0.137)	(0.236)	(0.725)
# other files in 6–10th percentile	-2.133***	-0.943***	-9.715***	-18.71***
	(0.0776)	(0.225)	(0.876)	(1.874)
# other files in 11–15th percentile	-2.648***	-1.969***	-12.03***	-24.26***
	(0.0747)	(0.218)	(0.843)	(1.927)
# other files in 16–20th percentile	-2.876***	-2.645***	-14.00***	-26.56***
	(0.0697)	(0.203)	(0.696)	(1.808)
# other files in 21–25th percentile	-2.990***	-2.923***	-14.21***	-26.61***
	(0.0690)	(0.204)	(0.712)	(1.717)
# other files in >25 percentile	-3.028***	-4.672***	-12.21***	-18.27***
	(0.0649)	(0.163)	(0.666)	(1.425)
N	232,895	232,895	232,895	232,895
R^2	0.124	0.618	0.031	0.184

TABLE 4

Attention to complex news within regime

This table shows coefficients of OLS regressions (each row represents one regression) for 8-Ks filed in the time given in the caption (9:30 am–3:59 pm, 4:00–5:30 pm, or 5:35 pm–5:59 am), and standard errors in brackets underneath. The dependent variable is the number of downloads (including automated) per 8-K filing, counted for the first five minutes after becoming public in Panel A (B), and for the first 24 hours in Panel C (D). Independent variables in addition to the variable named in the row caption include year, month, day of the week fixed effects, and firm fixed effects in columns 1–3. Standard errors are clustered by firm-days. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Downloads in the first 5 minutes after posting, excluding automated

	(1)	(2)	(3)	(4)	(5)	(6)
Period	9:30 am–3:59 pm	4:00–5:30 pm	5:35 pm–5:59 am	9:30 am–3:59 pm	4:00–5:30 pm	5:35 pm–5:59 am
Firm FE	Yes	Yes	Yes	No	No	No
# items	0.140***	0.101***	0.00127	0.124***	0.0796***	0.00113
	(0.0127)	(0.00909)	(0.00421)	(0.0114)	(0.00872)	(0.00328)
Length	2.47e-05***	1.46e-05***	2.66e-07	3.50e-05***	2.12e-05***	2.18e-07
	(4.05e-06)	(2.54e-06)	(8.65e-07)	(3.44e-06)	(3.49e-06)	(8.38e-07)
Length (total)	2.71e-06***	3.97e-06***	1.27e-07	4.14e-06***	5.27e-06***	1.23e-07
	(1.05e-06)	(5.64e-07)	(1.58e-07)	(1.42e-06)	(6.67e-07)	(1.67e-07)
Fog	0.0126***	0.00929***	0.000368	0.0126***	0.00916***	0.000365
	(0.00237)	(0.00191)	(0.000787)	(0.00177)	(0.00144)	(0.00127)

Panel B: Downloads in the first 5 minutes after posting, including automated

	(1)	(2)	(3)	(4)	(5)	(6)
Period	9:30 am–3:59 pm	4:00–5:30 pm	5:35 pm–5:59 am	9:30 am–3:59 pm	4:00–5:30 pm	5:35 pm–5:59 am
Firm FE	Yes	Yes	Yes	No	No	No
# items	1.420***	1.117***	0.0223	1.256***	0.915***	0.0169
	(0.0613)	(0.0536)	(0.0281)	(0.0570)	(0.0515)	(0.0247)
Length	0.000217***	0.000197***	-1.38e-06	0.000274***	0.000234***	-2.23e-06
	(2.49e-05)	(2.03e-05)	(3.09e-06)	(2.33e-05)	(2.00e-05)	(4.18e-06)
Length (total)	2.28e-05	5.90e-05***	-1.43e-06	3.69e-05**	6.94e-05***	-1.49e-06
	(1.62e-05)	(7.10e-06)	(2.08e-06)	(1.59e-05)	(6.93e-06)	(2.71e-06)
Fog	0.0538***	0.0674***	0.00728*	0.0377***	0.0746***	0.00735
	(0.0121)	(0.0116)	(0.00386)	(0.00919)	(0.00972)	(0.00702)

Panel C: Downloads in the first 24 hours after posting, excluding automated

	(1)	(2)	(3)	(4)	(5)	(6)
Period	9:30 am–3:59 pm	4:00–5:30 pm	5:35 pm–5:59 am	9:30 am–3:59 pm	4:00–5:30 pm	5:35 pm–5:59 am
Firm FE	Yes	Yes	Yes	No	No	No
# items	3.773***	4.812***	1.882***	3.300***	4.312***	1.857***
	(0.209)	(0.386)	(0.262)	(0.161)	(0.307)	(0.179)
Length	0.000603***	0.000636***	0.000278***	0.000770***	0.000777***	0.000275***
	(6.21e-05)	(6.78e-05)	(6.05e-05)	(5.38e-05)	(6.63e-05)	(4.29e-05)
Length (total)	7.27e-05**	0.000218***	2.70e-05	9.28e-05**	0.000244***	2.66e-05
	(3.26e-05)	(1.94e-05)	(2.00e-05)	(3.98e-05)	(1.92e-05)	(1.95e-05)
Fog	0.0538***	0.0674***	0.00728*	0.0377***	0.0746***	0.00735
	(0.0121)	(0.0116)	(0.00386)	(0.00919)	(0.00972)	(0.00702)

Panel D: Downloads in the first 24 hours after posting, including automated

	(1)	(2)	(3)	(4)	(5)	(6)
Period	9:30 am–3:59 pm	4:00–5:30 pm	5:35 pm–5:59 am	9:30 am–3:59 pm	4:00–5:30 pm	5:35 pm–5:59 am
Firm FE	Yes	Yes	Yes	No	No	No
# items	10.51***	14.04***	4.168***	9.437***	11.38***	4.146***
	(0.505)	(0.792)	(0.524)	(0.424)	(0.710)	(0.575)
Length	0.00162***	0.00200***	0.000581***	0.00229***	0.00274***	0.000592***
	(0.000196)	(0.000221)	(0.000133)	(0.000165)	(0.000235)	(0.000107)
Length (total)	0.000209*	0.000682***	4.52e-05	0.000385**	0.000911***	4.47e-05
	(0.000126)	(7.43e-05)	(6.66e-05)	(0.000154)	(7.49e-05)	(8.81e-05)
Fog	0.480**	1.221***	0.259**	0.762***	1.207***	0.260
	(0.229)	(0.174)	(0.126)	(0.121)	(0.151)	(0.195)

TABLE 5

Complexity

Panel A shows estimates for the difference at cutoff (post-5:30 minus pre-5:30 pm) from local linear regressions with an optimal bandwidth defined as in Calonico, Cattaneo, and Farrell (2020). Panel B shows global regressions with time polynomials of order four to each side of the discontinuity, where *overnight* is an indicator variable for filings filed between 5:35 pm and 5:59 am. The dependent variables are: *# Items*, the number of different items filed within one filing; *Length*, the word count of the documents in the filing (average per attachment, or the total of all attachments); and *Fog*, the Fog index of text readability. Filings from 5:30 to 5:34 are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: At 5:30 pm

	(1)	(2)	(3)	(4)
	# Items	Length	Length (total)	Fog (avg.)
Post- minus pre-	-0.270	-1,106	-4,498	-0.679
p-value	0.000	0.000	0.000	0.007
Bandwidth (in % of h)	31.751	30.254	29.732	45.754
N pre-	25,863	24,531	24,181	29,814
N post-	2,632	2,494	2,448	2,916

Panel B: All overnight

	(1)	(2)	(3)	(4)
	# Items	Length	Length (total)	Fog (avg.)
Overnight	-0.187***	-742.5***	-3,068***	-0.908***
	(0.0190)	(77.08)	(284.0)	(0.136)
N	231,861	229,216	229,216	191,837
R^2	0.004	0.005	0.006	0.005

TABLE 6

Price formation

Panel A (Panel B) displays the returns at different horizons of filings that have a positive (negative) return after 10 days, separately for pre-cutoff and post-cutoff filings, and the difference between the two samples. High-attention filings correspond to those filed 4:30–5:29 pm. Low-attention filings correspond to those filed 5:30 pm–6:00 am. Returns are measured from market closure of the session previous to the news release up to the period indicated in the caption. Sample characteristics are matched by reweighting low-attention filings using entropy matching to match the first, second, and third moments of Fog, the number of items, the length of the filing, the day of the week, the year, the filing item, and Fama-French 49 industry classification across both subsamples. Filings from 5:30 to 5:34 pm are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Conditioning on return after 10 days being positive

	(1)	(2)	(3)	(4)	(5)	(6)
Return % →	Opening	1 day	2 days	3 days	5 days	10 days
High-attention filing	0.00629***	0.0128***	0.0209***	0.0281***	0.0421***	0.0760***
4:30 pm–5:29 pm	(0.000676)	(0.000762)	(0.000893)	(0.000989)	(0.00111)	(0.00117)
Low-attention filing	0.00425***	0.0101***	0.0193***	0.0265***	0.0406***	0.0760***
5:30 pm–6:00 am	(0.000932)	(0.00104)	(0.00131)	(0.00137)	(0.00155)	(0.00175)
Return difference	0.00204*	0.00273**	0.00157	0.00161	0.00155	-5.45e-05
	(0.00115)	(0.00129)	(0.00158)	(0.00169)	(0.00190)	(0.00211)
Relative difference	32.4%	21.3%	7.5%	5.7%	3.7%	0.1%
N	22,148	22,148	22,148	22,148	22,148	22,148

Panel B: Conditioning on return after 10 days being negative

	(1)	(2)	(3)	(4)	(5)	(6)
Return % →	Opening	1 day	2 days	3 days	5 days	10 days
High-attention filing	-0.00314***	-0.0124***	-0.0206***	-0.0282***	-0.0436***	-0.0810***
4:30 pm–5:29 pm	(0.000293)	(0.000403)	(0.000491)	(0.000555)	(0.000662)	(0.000784)
Low-attention filing	-0.00101**	-0.00921***	-0.0182***	-0.0272***	-0.0424***	-0.0808***
5:30 pm–6:00 am	(0.000432)	(0.000609)	(0.000822)	(0.000946)	(0.00113)	(0.00142)
Return difference	-0.00212***	-0.00322***	-0.00234**	-0.000995	-0.00118	-0.000202
	(0.000522)	(0.000731)	(0.000957)	(0.00110)	(0.00131)	(0.00162)
Relative difference	67.5%	26.0%	11.4%	3.6%	2.7%	0.2%
N	22,961	22,961	22,961	22,961	22,961	22,961

TABLE 7

Price formation for complex news

Panel A (Panel B) displays the differences in returns between 4:30–5:29 pm and 5:30 pm–6:00 am filings, at the time horizon indicated in the column title, of filings that have a positive (negative) return after 10 days. We classify a filing as "complex" if its readability, length, and number of items are all above median, and "not complex" if otherwise. Returns are measured from market closure of the session previous to the news release up to the period indicated in the caption. Sample characteristics are matched by reweighting low-attention filings using entropy matching to match the first, second, and third moments of Fog, the number of items, the length of the filing, the day of the week, the year, the filing item, and Fama-French 49 industry classification across both subsamples. Filings from 5:30 to 5:34 pm are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Conditioning on return after 10 days being positive

	(1)	(2)	(3)	(4)	(5)	(6)
Return % →	Opening	1 day	2 days	3 days	5 days	10 days
Absolute differences in returns						
All filings	0.00204*	0.00273**	0.00157	0.00161	0.00155	-5.45e-05
Not complex filings	0.00101	0.00126	-0.000404	-0.000929	-0.000514	-0.000517
Complex filings	0.00367***	0.00519***	0.00513**	0.00624***	0.00590*	0.00137
Relative differences in returns						
All filings	32.4%	21.3%	7.5%	5.7%	3.7%	0.1%
Not complex filings	18.4%	9.9%	-2.0%	-3.4%	-1.3%	-0.7%
Complex filings	49.1%	37.9%	23.3%	20.7%	13.1%	1.7%

Panel B: Conditioning on return after 10 days being negative

	(1)	(2)	(3)	(4)	(5)	(6)
Return % →	Opening	1 day	2 days	3 days	5 days	10 days
Absolute differences in returns						
All filings	-0.00212***	-0.00322***	-0.00234**	-0.000995	-0.00118	-0.000202
Not complex filings	-0.00200***	-0.00289***	-0.00231**	-0.00102	-0.000676	-9.40e-05
Complex filings	-0.00239**	-0.00418***	-0.00292	-0.00159	-0.00267	-0.000363
Relative differences in returns						
All filings	67.5%	26.0%	11.4%	3.6%	2.7%	0.2%
Not complex filings	64.7%	24.3%	11.7%	3.8%	1.6%	0.1%
Complex filings	73.8%	30.1%	12.6%	5.0%	5.6%	0.4%

TABLE 8

Liquidity

Panel A shows estimates for the difference at cutoff (post-5:30 minus pre-5:30 pm) from local linear regressions with an optimal bandwidth defined as in Calonico, Cattaneo, and Farrell (2020). Panel B displays differences in the variable given in the caption between 4:30–5:29 pm and 5:30 pm–6:00 am filings, at the time horizon indicated in the column title. Sample characteristics in Panels B and C are matched by reweighting filings using entropy matching to match the first, second, and third moments of Fog, the number of items, the length of the filing, the day of the week, the year, the filing item, and Fama-French 49 industry classification across both subsamples. Filings from 5:30 to 5:34 pm are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: RDD

Variables	(1) Dollar volume	(2) Number of trades	(3) Buy volume	(4) Sell volume	(5) Realized spread	(6) Quoted spread	(7) Intraday volatility
RD_Estimate (post 5:30 pm–pre-5:30 pm)	-2.548e+07	-4,926	-635,390	-724,465	0.00125	0.00120	4.59e-07
Conventional p-value	0.022	0.000	0.000	0.000	0.040	0.149	0.702
Robust p-value	0.051	0.000	0.001	0.000	0.115	0.312	0.949
Bandwidth % hour	39.542	30.898	32.210	27.440	56.994	35.325	31.876

Panel B: Matched sample – Interval 4:30 pm–6:00 am

Variables	(1) Dollar volume	(2) Number of trades	(3) Buy volume	(4) Sell volume	(5) Realized spread	(6) Quoted spread	(7) Intraday volatility
4:30 pm–5:30 pm filings	1.113e+06***	1.108e+06***	6.162e+07***	8,537***	0.00759***	0.00641***	4.13e-06***
	(24,891)	(24,474)	(1.499e+06)	(159.5)	(0.000126)	(7.49e-05)	(1.25e-07)
5:30 pm–6:00 am filings	883,999***	871,628***	4.862e+07***	7,139***	0.00761***	0.00653***	4.46e-06***
	(41,622)	(40,877)	(2.483e+06)	(272.6)	(0.000253)	(0.000152)	(2.64e-07)
Difference	228,805***	236,157***	1.301e+07***	1,398***	-2.77e-05	-0.000117	-3.25e-07
	(48,497)	(47,643)	(2.900e+06)	(315.8)	(0.000283)	(0.000169)	(2.92e-07)
N	18,497	18,497	18,538	18,538	28,061	28,040	28,061
R^2	0.122	0.124	0.105	0.168	0.144	0.259	0.050

Panel C: Matched sample – Interval 5:15 pm–6:00 am

Variables	(1) Dollar volume	(2) Number of trades	(3) Buy volume	(4) Sell volume	(5) Realized spread	(6) Quoted spread	(7) Intraday volatility
5:15 pm–5:30 pm filings	1.132e+06***	1.129e+06***	6.441e+07***	8,823***	0.00724***	0.00623***	3.73e-06***
	(45,463)	(44,613)	(2.871e+06)	(299.8)	(0.000222)	(0.000133)	(2.13e-07)
5:30 pm–6:00 am filings	883,999***	871,628***	4.862e+07***	7,139***	0.00761***	0.00653***	4.46e-06***
	(41,625)	(40,880)	(2.483e+06)	(272.6)	(0.000253)	(0.000152)	(2.64e-07)
Difference	247,519***	257,062***	1.579e+07***	1,684***	-0.000374	-0.000300	-7.30e-07**
	(61,640)	(60,510)	(3.796e+06)	(405.2)	(0.000337)	(0.000202)	(3.39e-07)
N	7,930	7,930	7,939	7,939	12,259	12,252	12,259
R^2	0.124	0.126	0.105	0.170	0.141	0.258	0.048

Appendix: Proofs

Equilibrium conditions

An equilibrium is characterized by A_L^*, A_E^*, and $\varepsilon^*(C)$, that are best responses to each other.

In equilibrium, the optimal responses of filers and investors are driven by:

$\pi(a_L^*\ C\ ) - \pi(a_E^*\ C\ ) = \varepsilon^*(C)$, and

$f'(A_L^*/N_L^*) = \lambda f'(A_E^*/N_E^*) = \lambda K'(A_E^* + \lambda A_L^*)$,

where: $\alpha_t^* = A_t^*/N_t^*$; $N_E^* = \int_0^{\bar{C}} \int_{\varepsilon(C)}^{\infty} C\ \ g(\varepsilon)\, h(C)\, dC\, d\varepsilon$; and $N_L^* = N - N_E^*$.

Proof of Lemma 1:

Given a level of aggregate attention in a regime, the investor problem consists in distributing attention across all the available ideas in the regime. Given the convexity of $f(.)$, the optimal strategy of the investor equalizes the marginal return to attention across ideas by allocating the same a to each of them.

Proof of Proposition 1:

Given the FOCs, we can write $f'(A_L^*/N_L) = \lambda f'(A_E^*/N_E)$. Given that $\lambda > 1$ and $f''(a) < 0$, we can determine that $A_L^*/N_L < A_E^*/N_E$, which is equivalent to the proposition.

Proof of Proposition 2:

- Given the indifference condition $\pi(a_L^*\ C\ ) = \pi(a_E^*\ C\ ) + \varepsilon^*(C)$, it follows that $\pi(a_L^*\ C\ ) > \pi(a_E^*\ C\ ) + \varepsilon$ for $\varepsilon\ < \varepsilon^*(C)$, inducing firms to file late, and vice-versa for $\varepsilon\ > \varepsilon^*(C)$, inducing filers to file early. Hence, filers with $\varepsilon < \varepsilon^*(C)$ file late, and those with $\varepsilon > \varepsilon^*(C)$ file early.

- Given that $\pi'(.) > 0$ and that $a_L^* < a_E^*$, it follows that $\pi(a_E^*\ C) - \pi(a_L^*\ C)$ is increasing in C, so $\varepsilon^*(C)$ is also increasing in C.

- Given that ε is independent of C (i.e., equally distributed across C), the fact that $\varepsilon^*(C)$ is increasing in C implies that for a higher C a higher fraction of filings is filed early.

- Note that: given an A_E and an A_L, one can always uniquely determine $N_E = \int_0^{\bar{C}} \int_{\varepsilon(C)}^{\infty} C \quad g(\varepsilon)\, h(C)\, dC\, d\varepsilon$ and $N_L = N - N_E$.

To see this, one can start from an expected N_E and determine $\varepsilon\left(\mathrm{C}, \frac{A_E}{N_E}, \frac{A_L}{N-N_E}\right)$, then compute the best-response from the filers $\widetilde{N}_E = \int_0^{\bar{C}} \int_{-\infty}^{\varepsilon\left(\mathrm{C}, \frac{A_E}{N_E}, \frac{A_L}{N-N_E}\right)} C \quad g(\varepsilon)\, f(C)\, dC$, which is a continuous function. Starting with $N_E = 0$ then $\widetilde{N}_E > N_E$: As we increase N_E, then $\varepsilon\left(\mathrm{C}, \frac{A_E}{N_E}, \frac{A_L}{N-N_E}\right)$ increases for all C, so $\widetilde{N}_E$ decreases. At $N_E = N$ then $\widetilde{N}_E < N_E$. By continuity, we can determine that there is single point in which the expected N_E equals the best response $\widetilde{N}_E$. So, given A_L and A_E, one can compute $N_E(A_L, A_E)$, which is a continuous function.

Proof of Proposition 3:

The attention per filing is Ca_t^*.

According to Proposition 2, the higher the C, the higher the fraction of filers that file early. So, if we define C_t as the average complexity of a filing in period t, then in equilibrium we know that $C_E^* > C_L^*$. According to Proposition 1, $a_L^* < a_E^*$. It follows that $a_E^* C_E^* > C_E^* a_L^*$.

External Appendix

External Appendix: Other sources of heterogeneity

A.1 Long-run trends

Information processing and trading speed have accelerated in recent years, resulting in fundamental changes in liquidity (Martineau, 2021), reporting habits (Cao, Jiang, Yang, and Zhang, 2021), and other market characteristics. Panel T of Table A.6 reports the difference between post-5:30 pm and pre-5:30 pm filings for each of our sample years. The estimates vary across the years, but there are no clear general trends. Readability is the weakest of our results, and is only significantly negative for some of the years.

The 2006 implementation of the Regulation National Market System is particularly important because it led to significantly more algorithmic trading. In Table A.6 (Panel U), we report our main regressions pre-2006 and post-2006. The only significant difference between the two time periods is in the number of downloads. Our main results on the complexity of filings across the threshold are not significantly different between the two time periods.

A.2 Firm characteristics

How do our results vary across firms? We have previously shown that they are driven by cross-sectional as well as within-firm variation. Firms may differ in their information environment and the potential price impact of information. In Panels V, W, and X of Table A.6, we report sample splits by size, liquidity, and profitability. We report the post-cutoff minus pre-cutoff differences for the highest and lowest quintiles (measured by year) of market capitalization, the Amihud (2002) illiquidity measure, and the return on assets.

The change in attention around the cutoff is significantly more pronounced for illiquid firms. For filing complexity, none of the subsample differences are statistically significant. The prevalence of stark differences at the cutoff across subsamples suggests that our results do not represent the "niche" attention management strategies of especially complex or transparent firms.

A.3 Fridays

The previous literature postulates that investors have a smaller attention span on Friday nights (e.g., Dellavigna and Pollet, 2003). The interaction between Fridays and the 5:30 pm cutoff effect is in principle ambiguous. On the one hand, the difference in time to read filings before markets open is exacerbated by the length of time between Friday and Monday morning. On the other, attention just before 5:30 pm on Friday may be lower.

We compare the results for filings on Fridays to those on other weekdays (Panel Y of Table A.6). Neither the estimates for attention nor for complexity are significantly different between Fridays and other weekdays.

A.4 Correlation with complexity

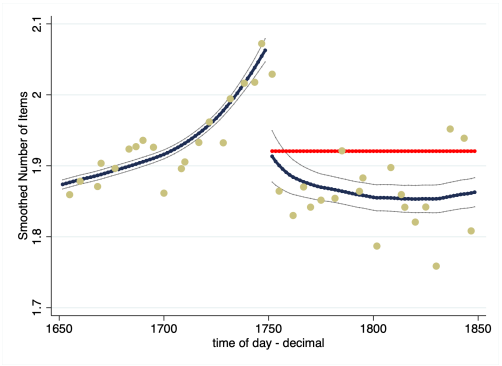
In our analytical framework, we assume that other reasons for timing news are orthogonal to the benefits of attention targeting. We now explicit test this assumption directly. In Table A.7, we report correlations between complexity and our measures for other motives to time filings around the threshold. None of the measures is more than 5% correlated with all complexity measures. When we measure correlations only for the time period between 4.30 pm and 6:00 am, the only measure that is more than 5% correlated with all complexity measures is leverage.

Figure A.1. Analysis including 5:30–5:34 filings

This figure shows local linear regressions with 10% confidence intervals and a bandwidth of 30 minutes, allowing for discrete jumps at 5:30 and with triangular weighting. It replicates the results of Figures IV and V without excluding filing accepted between 5:30 and 5:34. See notes to Figures IV and V for variable definitions.

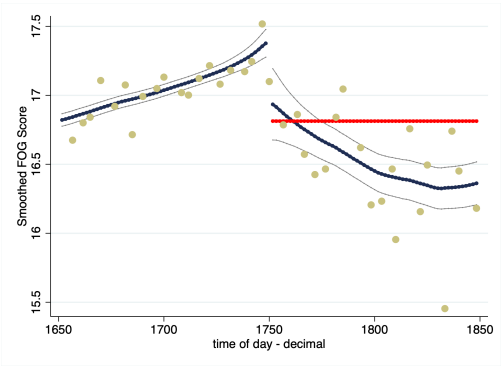
Panel A

Number of items per filing



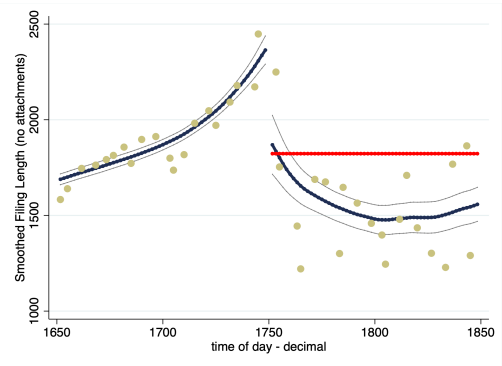
Panel B

Fog measure of text readability, per filing



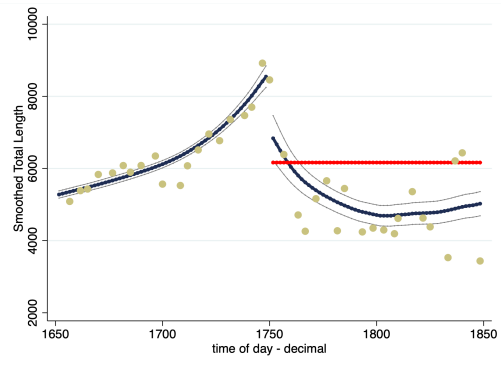
Panel C

Length of a filing in words



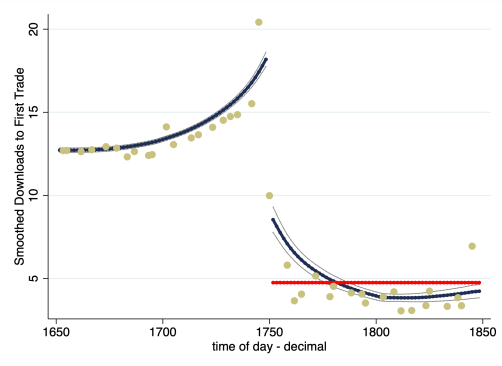
Panel D

Length of a filing in words, with attachments



Panel F

Downloads before first trade



Panel G

Downloads first 24h

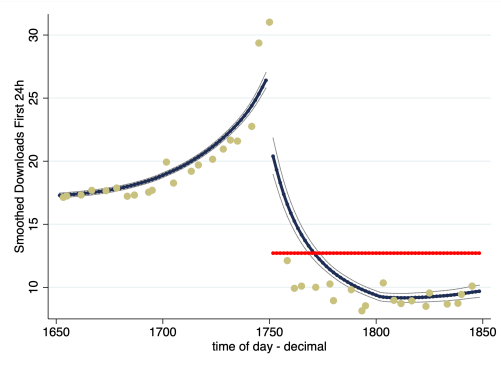


Figure A.2. Form 4 filings

This figure shows the aggregate number of Form 4 filings filed between September 2004 and March 2012, ordered by the 10-minute interval of their public appearance on EDGAR (bars) and the average number of total downloads for each filing (line).

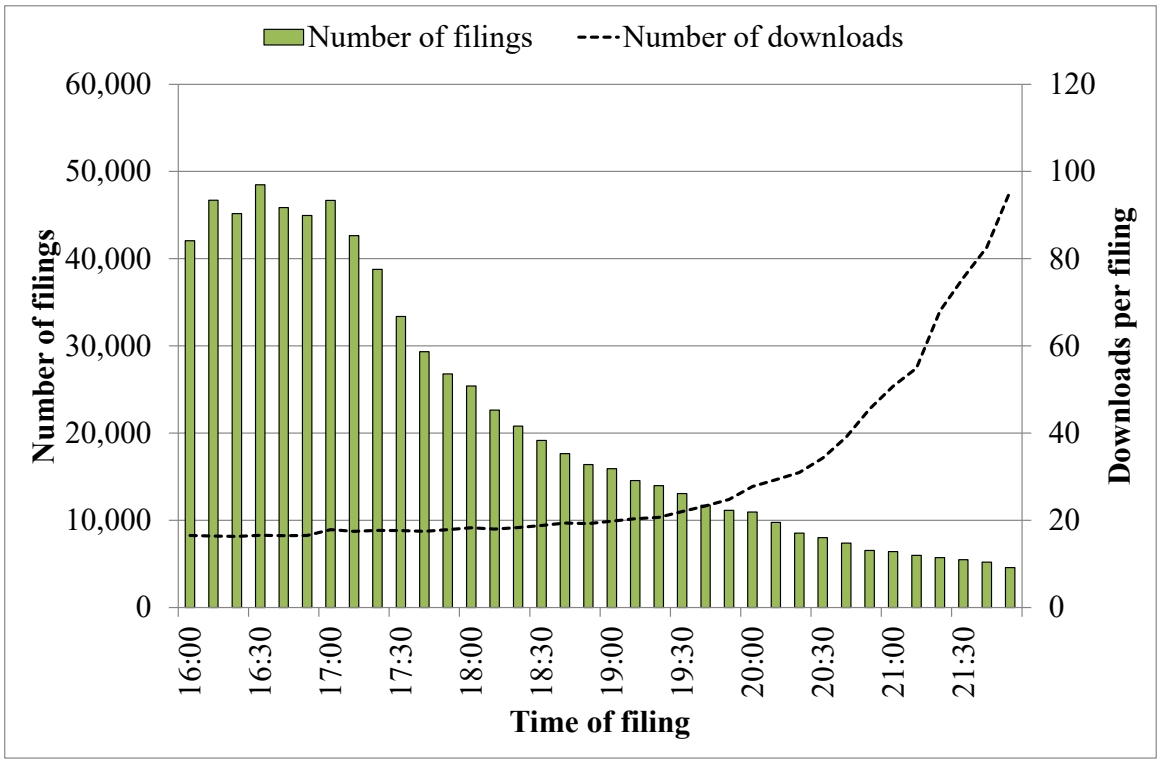


TABLE A.1

Between-firm vs. within-firm variation

This table shows regression estimates for the jump in the dependent variable at 5:30 pm. The specification is based on global regressions with time polynomials of order four to each side of the discontinuity. Panel A shows between-firm estimators of firm averages. Panel B is a within-group estimator with firm fixed effects. The dependent variables are: "# Items," the number of different items filed within one filing; "Length," the word count of the documents in the filing (of the filing or additionally all attachments); and "Fog," the Fog index of text readability. Filings from 5:30 to 5:34 are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Between firms

	(1) # Items	(2) Length	(3) Length (total)	(4) Fog (avg.)
Overnight	-0.0544***	-196.5***	-708.2***	-0.150
	(0.0144)	(51.95)	(197.4)	(0.124)
N	115,706	115,149	115,149	114,812
R^2	0.002	0.002	0.003	0.001
Between-Firm SD	0.52	1776	7234	3.65
Overnight/SD	10%	11%	10%	4%

Panel B: Within firms

	(1) # Items	(2) Length	(3) Length (total)	(4) Fog (avg.)
Overnight	-0.215***	-806.5***	-3,599***	-0.490***
	(0.0289)	(113.2)	(449.3)	(0.160)
N	115,704	114,310	114,310	94,733
R^2	0.004	0.003	0.005	0.003
Within-Firm SD	0.83	3482	13131	4.1
Overnight/SD	26%	23%	27%	12%

TABLE A.2

Filing agents

This table shows regression estimates for the jump in the dependent variable at 5:30 pm. The specification is based on global regressions with time polynomials of order four to each side of the discontinuity. Panel A shows between-firm estimators of filing agent averages. Panel B is a within-group estimator with filing agent fixed effects. The dependent variables are: "# Items," the number of different items filed within one filing; "Length," the word count of the documents in the filing (average by attachment or sum of all attachments); and "Fog," the Fog index of text readability. Filings from 5:30 to 5:34 pm are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Between filing agents

	(1) # Items	(2) Length	(3) Length (total)	(4) Fog (avg.)
Overnight	-0.0343**	-228.3***	-804.3***	-0.416**
	(0.0168)	(62.81)	(245.2)	(0.192)
N	97,280	97,280	97,280	97,280
R^2	0.003	0.009	0.009	0.006
Within-Filing A. SD	0.23	801	3234	2.32
Overnight/SD	15%	28%	25%	18%

Panel B: Within-filing agents

	(1) # Items	(2) Length	(3) Length (total)	(4) Fog (avg.)
Overnight	-0.228***	-856.0***	-3,807***	-0.534**
	(0.0361)	(193.2)	(796.7)	(0.247)
N	97,278	96,162	96,162	80,083
R^2	0.005	0.004	0.006	0.002
Within-Filing A. SD	0.91	3757	14358	5.01
Overnight/SD	25%	23%	27%	11%

TABLE A.3

Item types

This table shows regression estimates for the jump in the dependent variable at 5:30 pm. The specification is based on global regressions with time polynomials of order four to each side of the discontinuity and controlling for item type fixed effects. The dependent variables are: "# Items," the number of different items filed within one filing; "Length," the word count of the documents in the filing (average by attachment or sum of all attachments); and "Fog," the Fog index of text readability. Filings from 5:30 to 5:34 pm are excluded. *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)
	# Items	Length	Length (total)	Fog (avg.)
Post- minus pre-	0	-519.5	-1,814	-0.591
p-value	1.000	0.000	0.000	0.006
Bandwidth (in % of h)	641.667	39.681	45.841	46.862
N pre-	98,227	30,993	35,445	30,492
N post-	17,452	3,095	3,552	2,980

TABLE A.4

Univariate statistics for additional measures

This table shows univariate statistics for measures not used in tables of the main text.

Variable	Obs.	Mean	Median	Std. dev.	Min.	Max.
East coast HQ	125,961	0.50	0	0.50	0	1.00
West coast HQ	125,961	0.20	0	0.40	0	1.00
Trading volume	226,004	35.02	0.26	203.36	0	20,323.20
Absolute returns (10-day)	164,226	0.08	0.04	0.12	0	5.70
>2 days since event	228,756	2.63	1.00	14.17	0	1,515.00
Returns (10-day)	164,226	-0.00	-0.00	0.14	-2.73	5.70
Institutional ownership	232,895	0.38	0.27	0.38	0	1.00
Foreign institutional ownership	232,895	0.03	0.00	0.07	0	1.00
Domestic institutional ownership	232,895	0.35	0.24	0.36	0	1.00
Top 5 institutional ownership	232,895	0.16	0.16	0.16	0	1.00
Ownership concentration	160,918	0.17	0.07	0.24	0.01	1.00
Dedicated investors	232,895	0.01	0	0.04	0	0.29
Quasi-indexers	141,470	0.41	0.43	0.24	0.00	0.92
Transient investors	141,470	0.13	0.11	0.11	0	0.45
Value investors	232,895	0.13	0.07	0.16	0	0.65
Growth investors	141,470	0.12	0.08	0.12	0	0.54
Overnight macro news (yes/no)	232,895	0.22	0	0.42	0	1.00
Industry filing #	232,895	33.03	12.00	51.76	1.00	850.00
Industry registration filing #	232,895	2.36	0	4.95	0	180.00
Industry insider filing #	232,895	15.90	5.00	29.19	0	507.00
Industry 8-K #	232,895	6.26	3.00	8.52	1.00	83.00
Industry periodic filing #	232,895	2.65	1.00	7.78	0	163.00
Analyst coverage	139,427	7.68	6.00	6.75	1.00	52.00
Analyst forecast dispersion	137,875	78.01	1.20	579.11	0.00	5,657.30
Early sample	232,895	0.21	0	0.41	0	1.00
Market capitalization	164,943	4,408,230	479,820	15,200,000	0	116,000,000
Liquidity	83,545	0.02	0.00	0.11	0.00	1.52
ROA	173,591	-0.00	0.04	0.24	-3.99	26.60
Leverage	208,560	0.43	0.32	0.83	-0.70	7.57
M/B	200,055	2.17	1.50	5.81	-23.64	33.69
Cash/Assets	208,762	0.10	0.05	0.13	0	0.57
Tangibility	183,758	0.28	0.18	0.38	0	30.53
Friday	232,895	0.22	0	0.41	0	1.00
Press release	226,004	0.38	0	0.49	0	1.00
Event day	232,895	0.35	0	0.48	0	1.00
Voluntary	232,895	0.39	0	0.49	0	1.00
Amendment	232,895	0.03	0	0.17	0	1.00
Newswire	232,895	0.04	0	0.19	0	1.00
Newswire on day of previous market close	232,895	0.03	0	0.17	0	1.00
Newswire on day of next trade	232,895	0.03	0	0.16	0	1.00

TABLE A.5

Subsample densities

This table shows estimates for the difference in filing mass at cutoff (post-5:30 minus pre-5:30 pm) from local linear regressions with an optimal bandwidth defined as in Calonico, Cattaneo, and Farrell (2020), for subsamples of the highest and lowest quintiles of the variables inicated in the row caption. Column 1 (2) reports the difference in density for the highest (lowest) quintile or, for binary variables, where the condition is (not) fulfilled, and Column 3 reports the difference between these. Column 4 (5) reports the t-statistic of difference between subsamples in terms of the filing mass left (right) of the cutoff. Filings from 5:30 to 5:34 are excluded.

Sample		1 High/1 L–R	2 Low/0 L–R	3 Difference L–R	4 High – Low/1-0 tL	5 tR
Location	East coast HQ	0.34%		1.25	2.54	1.08
	West coast HQ	0.28%				
Relevance	Trading volume	0.16%	0.12%	0.70	-1.91	-1.97
	Absolute returns (10-day)	0.32%	0.27%	0.94	2.23	1.07
Urgency	>2 days since event	0.33%	0.30%	0.85	-2.08	-3.75
Returns	Returns (10-day)	0.31%	0.30%	0.16	0.37	0.17
Ownership	Institutional ownership	0.32%	0.34%	-0.52	-2.01	-1.54
	Foreign institutional ownership	0.34%	0.31%	0.84	-0.07	-1.36
	Ownership concentration	0.31%	0.34%	-0.63	0.53	1.57
	Dedicated investors	0.30%	0.31%	-0.39	-1.44	-1.05
	Quasi-indexers	0.32%	0.25%	1.46	2.57	0.66
	Transient investors	0.32%	0.35%	-0.72	1.20	2.65
News environment	Overnight macro news (yes/no)	0.39%	0.28%	2.86	1.91	-2.19
	Industry filing #	0.34%	0.33%	0.09	0.79	0.81
	Industry registration filing #	0.37%	0.29%	1.84	2.47	0.08
	Industry insider filing #	0.32%	0.33%	-0.20	-0.42	-0.19
	Industry 8-K #	0.34%	0.31%	0.88	0.61	-0.64
	Industry periodic filing #	0.30%	0.32%	-0.46	1.20	2.04
	Analyst coverage	0.31%	0.35%	-0.79	-0.66	0.43
	Analyst forecast dispersion	0.31%	0.31%	-0.17	1.41	1.91
Firm characteristics	Market capitalization	0.30%	0.28%	0.31	0.93	0.58
	Liquidity	0.31%	0.31%	0.13	-1.01	-1.35
	ROA	0.32%	0.31%	0.37	1.08	0.68
Friday	Friday	0.25%	0.32%	-2.23	-4.99	-2.21

TABLE A.6

Heterogeneity

This table shows estimates for the difference at cutoff (post-5:30 minus pre-5:30 pm) from local linear regressions with an optimal bandwidth defined as in Calonico, Cattaneo, and Farrell (2020). Coefficients are reported for subsamples as indicated in the table title rows. The dependent variables are: "# Downloads," the number of downloads in the first 24 hours after becoming public (excluding automated ones); "# Items," the number of different items filed within one filing; "Total length," the word count of the documents in the filing (sum of all attachments); and "Fog," the Fog index of text readability. Filings from 5:30 to 5:34 are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A. East vs. West

	Downloads		# Items		Total length		Fog (avg.)	
	East	West	East	West	East	West	East	West
Overnight	-22.50***	-15.31***	-0.102**	-0.174***	-3,169***	-2,890***	-0.659**	-0.599***
	(4.948)	(2.791)	(0.0387)	(0.0530)	(594.3)	(750.3)	(0.261)	(0.364)
Difference	-7.2		0.07		-279		-0.06	
t-stat	-1.27		1.07		-0.29		-0.13	
N within	62,122	25,407	62,122	25,407	61,459	25,157	51,545	20,694

Panel B. Trading volume

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-14.04***	-25.06***	-0.252***	-0.158***	-2,877***	-3,674***	-0.363***	-0.468***
	(1.125)	(4.330)	(0.0362)	(0.0328)	(487.2)	(554.2)	(0.220)	(0.236)
Difference	11**		-0.1**		797		0.1	
t-stat	2.46		-2.05		1.08		0.31	
N within	94,992	44,868	64,743	73,705	64,060	72,739	64,060	72,739

Panel C. Absolute 10-day returns

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-17.67***	-16.20***	-0.222***	-0.207***	-3,335***	-3,031***	-0.812***	-0.155***
	(3.108)	(1.278)	(0.0478)	(0.0290)	(795.3)	(396.8)	(0.356)	(0.182)
Difference	-1.4		-0.02		-304		-0.66	
t-stat	-0.42		-0.36		-0.34		-1.65	
N within	33,139	100,453	33,139	100,453	32,714	99,399	27,578	82,695

Panel D: Number of days after the event

	Downloads		# Items		Total length		Fog (avg.)	
	<=2 days	>2 days	<=2 days	>2 days	<=2 days	>2 days	<=2 days	>2 days
Overnight	-19.30***	-13.84***	-0.171***	-0.238***	-3,205***	-2,748***	-0.839***	-0.215***
	(1.957)	(1.325)	(0.0205)	(0.0385)	(307.3)	(576.9)	(0.148)	(0.224)
Difference	-5.5**		0.06		-457		-0.62**	
t-stat	-2.33		1.38		-0.70		-2.31	
N within	163,451	68,410	163,451	68,410	162,482	66,734	137,998	53,839

Panel E. 10-day returns

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-18.62***	-15.10***	-0.228***	-0.183***	-4,371***	-2,656***	-0.696***	-0.241***
	(3.452)	(1.316)	(0.0481)	(0.0288)	(696.2)	(402.9)	(0.327)	(0.183)
Difference	-3.5		-0.04		-1715**		-0.45	
t-stat	-0.95		-0.71		-2.13		-1.20	
N within	32,243	100,795	32,243	100,795	31,899	99,730	26,851	82,923

Panel F. Institutional ownership

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-18.08***	-19.90***	-0.236***	-0.158***	-4,219***	-3,019***	-0.470***	-0.873***
	(1.424)	(5.586)	(0.0346)	(0.0385)	(513.6)	(660.0)	(0.219)	(0.280)
Difference	1.9		-0.08		-1200		0.4	
t-stat	0.33		-1.55		-1.43		1.13	
N within	71,644	46,940	71,644	46,940	70,842	46,361	59,442	38,515

Panel G. Foreign institutional ownership

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-17.12***	-22.46***	-0.240***	-0.119***	-3,942***	-2,574***	-0.458***	-0.436***
	(1.184)	(6.460)	(0.0309)	(0.0392)	(439.3)	(675.6)	(0.194)	(0.285)
Difference	5.3		-0.13***		-1368*		-0.02	
t-stat	0.81		-2.60		-1.70		-0.06	
N within	90,276	47,064	90,276	47,064	89,255	46,487	74,806	39,045

Panel H. Ownership concentration

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-24.45**	-16.40***	-0.151***	-0.231***	-3,019***	-3,760***	-0.758***	-0.531***
	(9.129)	(1.087)	(0.0480)	(0.0289)	(859.0)	(406.6)	(0.358)	(0.180)
Difference	-8		0.08		741		-0.22	
t-stat	-0.87		1.43		0.78		-0.55	
N within	32,732	102,763	32,732	102,763	32,331	101,653	27,188	85,369

Panel I. Dedicated ownership

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-13.06***	-24.88***	-0.205***	-0.175***	-2,989***	-3,022***	-0.678***	-0.489***
	(0.910)	(3.479)	(0.0241)	(0.0306)	(336.2)	(493.7)	(0.159)	(0.210)
Difference	11.8***		-0.03		33		-0.19	
t-stat	3.28		-0.77		0.06		-0.72	
N within	31,785	59,944	129,353	91,083	127,971	89,965	127,971	89,965

Panel J. Quasi-indexers

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-12.20***	-18.45***	-0.187***	-0.202***	-2,586***	-3,554***	-0.483**	-0.505***
	(1.650)	(2.319)	(0.0533)	(0.0261)	(683.8)	(383.3)	(0.349)	(0.169)
Difference	6.2**		0.02		968		0.02	
t-stat	2.18		0.34		1.23		0.05	
N within	108,698	73,573	27,854	119,241	27,595	117,837	27,595	117,837

Panel K. Transient ownership

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-13.47***	-17.32***	-0.212***	-0.202***	-2,966***	-3,228***	-0.771***	-0.515***
	(1.900)	(1.267)	(0.0541)	(0.0264)	(684.6)	(385.7)	(0.362)	(0.168)
Difference	3.9*		-0.01		262		-0.26	
t-stat	1.71		-0.17		0.33		-0.65	
N within	28,115	118,883	28,115	118,883	27,821	117,660	23,473	98,521

Panel L. Macroeconomic news

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-17.99***	-15.61***	-0.200***	-0.170***	-3,126***	-3,063***	-0.602***	-0.884***
	(1.773)	(1.827)	(0.0210)	(0.0382)	(315.0)	(568.4)	(0.142)	(0.256)
Difference	-2.3		-0.03		-63		0.28	
t-stat	-0.90		-0.69		-0.10		0.96	
N within	23,563	98,295	180,537	51,324	178,456	50,760	178,456	50,760

Panel M. Industry peer filings – Total

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-0.202***	-0.121***	-852.9***	-774.7***	-3,507***	-3,568***	-0.650***	-1.081***
	(0.0386)	(0.0416)	(170.4)	(152.2)	(604.2)	(587.2)	(0.262)	(0.285)
Difference	-0.08		-78		61		0.43	
t-stat	-1.41		-0.34		0.07		1.11	
N within	50,794	47,424	50,794	47,424	50,130	46,994	41,883	39,704

Panel N. Industry peer filings – Insiders

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-19.06***	-17.02***	-0.198***	-0.179***	-2,809***	-3,840***	-0.494***	-1.263***
	(2.110)	(2.190)	(0.0370)	(0.0419)	(591.4)	(586.9)	(0.251)	(0.282)
Difference	-2		-0.02		1031		0.77**	
t-stat	-0.66		-0.01		1.24		2.04	
N within	41,883	39,704	54,350	48,067	53,650	47,637	44,946	40,085

Panel O. Industry peer filings – 8-Ks

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-0.494***	-1.263***	-21.69***	-17.11***	-3,155***	-4,432***	-0.169**	-1.267***
	(0.251)	(0.282)	(4.233)	(2.465)	(539.7)	(599.2)	(0.235)	(0.280)
Difference	0.77**		-4.5		1277		1.1***	
t-stat	2.04		-0.92		1.58		3.01	
N within	53,650	47,637	44,946	40,085	62,929	49,444	52,614	42,005

Panel P. Industry peer filings – Registration

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-17.29***	-16.99***	-0.192***	-0.184***	-2,423***	-4,634***	-0.220***	-1.285***
	(2.400)	(2.198)	(0.0252)	(0.0393)	(377.3)	(592.8)	(0.170)	(0.270)
Difference	-0.3		-0.01		2211***		1.06***	
t-stat	-0.09		-0.21		3.15		3.32	
N within	118,989	53,168	118,989	53,168	117,469	52,709	97,381	44,769

Panel Q. Industry peer filings – Periodic

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-18.64***	-15.62***	-0.219***	-0.133***	-2,610***	-3,820***	-0.392***	-1.389***
	(2.581)	(1.825)	(0.0261)	(0.0379)	(403.8)	(542.9)	(0.177)	(0.257)
Difference	-3		-0.08*		1210*		0.99***	
t-stat	-0.95		-1.74		1.79		3.17	
N within	115,073	53,897	115,073	53,897	113,725	53,358	94,992	44,868

Panel R. Analyst coverage

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-14.80***	-18.62***	-0.223***	-0.182***	-3,401***	-2,927***	-1.553***	-0.308***
	(1.671)	(2.496)	(0.0472)	(0.0255)	(664.8)	(366.1)	(0.310)	(0.168)
Difference	3.8		-0.04		-474		-1.25***	
t-stat	1.27		-0.75		-0.62		-3.55	
N within	36,066	123,492	36,066	123,492	35,713	122,122	30,065	102,083

Panel S. Analyst forecast dispersion

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-14.04***	-17.00***	-0.235**	-0.208***	-2,794***	-3,183***	-1.414***	-0.541***
	(1.548)	(1.247)	(0.0540)	(0.0259)	(780.9)	(360.4)	(0.365)	(0.167)
Difference	3		-0.03		389		-0.87**	
t-stat	1.51		-0.50		0.45		-2.17	
N within	26,966	121,624	26,966	121,624	26,588	120,283	22,266	100,659

Panel T: By year

Year	# Downloads	# Items	Total length	Fog (avg.)
2004	-36.33***	-0.245**	-2,949***	-0.394
2005	-12.22***	-0.200***	-3,067***	-0.450***
2006	-7.448***	-0.175***	-3,029***	-0.785***
2007	-8.343***	-0.206***	-3,013***	-1.309***
2008	-14.83***	-0.173***	-2,958***	-0.632
2009	-24.65***	-0.211***	-4,316***	-0.492
2010	-22.07***	-0.209***	-2,578***	-0.623
2011	-39.54**	-0.166***	-2,866***	-0.260

Panel U. Pre-2006/post-2006

	Downloads		# Items		Total length		Fog (avg.)	
	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-
Overnight	-18.44***	-14.47***	-0.189***	-0.212***	-3,144***	-3,036***	-0.726***	-0.442***
	(1.795)	(1.143)	(0.0211)	(0.0375)	(320.1)	(525.6)	(0.141)	(0.257)
Difference	-4*		0.03		-108		-0.28	
t-stat	-1.88		0.70		-0.18		-0.96	
N within	183,287	48,574	183,287	48,574	181,203	48,013	181,203	48,013

Panel V. Market capitalization

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-13.81***	-19.61***	-0.189***	-0.173***	-2,416***	-2,942***	-0.429***	-0.251***
	(1.403)	(3.012)	(0.0508)	(0.0288)	(595.2)	(435.7)	(0.332)	(0.188)
Difference	5.8*		-0.01		526		-0.17	
t-stat	1.75		-0.17		0.71		-0.45	
N within	32,159	101,070	32,159	101,070	31,823	99,854	26,958	83,058

Panel W. Liquidity

	Downloads		# Items		Total length		Fog (avg.)	
	High	Low	High	Low	High	Low	High	Low
Overnight	-11.84***	-26.38***	-0.208***	-0.174***	-2,650***	-3,499***	-0.460***	-0.507***
	(1.139)	(3.212)	(0.0309)	(0.0295)	(409.0)	(475.8)	(0.198)	(0.198)
Difference	14.5***		-0.03		849		0.04	
t-stat	4.25		-0.70		1.35		0.14	
N within	82,370	99,805	82,370	99,805	81,467	98,605	68,875	81,479

Panel X. Profitability

	Downloads		# Items		Total length		Fog (avg.)	
	Low	High	Low	High	Low	High	Low	High
Overnight	-13.72***	-18.63***	-0.289***	-0.232***	-2,422***	-3,658***	-0.419**	-0.614***
	(1.548)	(1.419)	(0.0510)	(0.0287)	(590.6)	(436.7)	(0.315)	(0.194)
Difference	4.9**		-0.05		1236*		0.2	
t-stat	2.33		-0.85		1.68		0.54	
N within	33,050	93,936	33,050	93,936	32,699	92,835	32,699	92,835

Panel Y. Fridays

	Downloads		# Items		Total length		Fog (avg.)	
	Mo–Th	Fr	Mo–Th	Fr	Mo–Th	Fr	Mo–Th	Fr
Overnight	-18.63***	-11.49***	-0.197***	-0.173***	-2,888***	-3,823***	-0.555***	-1.085***
	(1.763)	(1.842)	(0.0208)	(0.0393)	(313.1)	(580.8)	(0.141)	(0.260)
Difference	-7.2***		-0.02		935		0.53*	
t-stat	-2.82		-0.45		1.42		1.79	
N within	181,115	50,746	181,115	50,746	179,065	50,151	150,260	41,577

TABLE A.7

Correlations

This table displays correlations between complexity and measures of potential other reasons for timing news.

	Entire sample				Between 16:30 and 6am			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	# Items	Length	Total length	Fog	# Items	Length	Total length	Fog
East coast HQ	-0.0358	-0.0013	0.0068	0.0008	-0.0039	0.0255	0.039	0.0087
West coast HQ	0.0149	-0.0329	-0.0375	0.0426	0.0064	-0.0486	-0.0504	0.0239
Trading volume	-0.0194	0.0311	0.036	0.0151	-0.0307	0.0318	0.0406	0.0138
Absolute returns (10-day)	-0.0026	-0.0265	-0.0258	-0.0217	-0.0142	-0.0301	-0.0273	-0.0466
>2 days since event	0.006	0.0283	0.0296	0.0214	0.0007	0.0281	0.0311	0.0056
Returns (10-day)	0.0061	0.0036	0.0048	0.0021	0.0012	0.0029	-0.0029	0.026
Institutional ownership	-0.006	0.0296	0.0256	0.0078	0.0299	0.0496	0.0447	-0.0064
Foreign institutional ownership	-0.01	0.0075	0.0121	0.0163	-0.0084	0.0088	0.0127	0.0149
Domestic institutional ownership	-0.0039	0.0288	0.0236	0.0042	0.0329	0.0493	0.0432	-0.0101
Top 5 institutional ownership	0.0176	-0.0034	-0.0118	-0.0062	0.0387	0.0043	-0.0043	-0.0311
Ownership concentration	0.0386	-0.0188	-0.0142	-0.0024	0.0266	-0.0192	-0.019	-0.0078
Dedicated investors	-0.0088	0.0154	0.0188	-0.0004	0.003	0.0231	0.0278	0.0052
Quasi-indexers	-0.0054	0.0202	0.0093	-0.0092	0.0333	0.0295	0.0183	-0.0271
Transient investors	0.0161	0.0272	0.0383	0.014	0.0217	0.0344	0.0483	-0.0014
Value investors	-0.0017	0.023	0.0146	-0.0273	0.0206	0.0328	0.0222	-0.0258
Growth investors	0.0021	0.0018	0.0037	0.0378	0.0201	0.0145	0.0162	0.0158
Overnight macro news (yes/no)	-0.0083	-0.0079	-0.0092	0.0015	-0.0091	0.0131	0.0061	0.0266
Industry filing #	-0.0165	-0.0384	-0.0267	0.0312	-0.0276	-0.0384	-0.0255	0.0318
Industry registration filing #	-0.0023	-0.0107	0.0059	0.0406	0.0078	0.0058	0.0251	0.0546
Industry insider filing #	-0.013	-0.0341	-0.027	0.0216	-0.0175	-0.0369	-0.0276	0.0173
Industry 8-K #	-0.0125	-0.0348	-0.0252	0.0267	-0.0257	-0.0377	-0.026	0.022
Industry periodic filing #	-0.0049	-0.0259	-0.0137	0.0281	-0.0093	-0.0237	-0.0133	0.0277
Analyst coverage	-0.022	0.0421	0.0467	0.0664	-0.0293	0.0485	0.0503	0.0613
Analyst forecast dispersion	0.0072	-0.0091	-0.0051	-0.0026	0.0024	-0.0081	-0.0068	0.0022
Early sample	-0.0253	-0.0321	-0.0356	0.0276	-0.0126	-0.038	-0.0373	0.0294
Market capitalization	-0.0477	0.0365	0.0418	0.0448	-0.0542	0.0294	0.0384	0.0502
Liquidity	-0.0009	-0.0127	-0.0117	-0.0072	-0.0068	-0.0074	-0.004	-0.0029
ROA	-0.0255	0.0163	0.0086	0.009	-0.0271	0.0039	-0.0027	0.0151
Leverage	0.0425	0.0746	0.0914	0.0372	0.0621	0.0759	0.0959	0.0572
M/B	-0.0164	-0.0092	-0.0113	0.0245	-0.0215	-0.0149	-0.0176	0.023
Cash/Assets	-0.0225	-0.0802	-0.0832	0.0127	-0.0367	-0.0731	-0.0809	-0.0088
Tangibility	0.0037	0.0071	0.0019	0.0111	0.0117	-0.0103	-0.0055	0.0219
Friday	-0.0067	0.0102	0.0089	0.0174	-0.0162	0.0032	0.0067	0.0189

TABLE A.8

Matching

This table displays the mean, variance, and skewness of the treatment group, i.e. the overnight filings (Columns 1–3), the unmatched control group (filings between 4:30–5:30 pm: Columns 4–6), and the matched control group (Columns 7–9). Variance of length is expressed per thousand words. Filings from 5:30 to 5:34 pm are excluded.

	Treatment			Control (unmatched)			Control (matched)		
	mean	variance	skewness	mean	variance	skewness	mean	variance	skewness
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Fog	16.6	30.87	0.3112	16.95	29.38	0.2648	16.6	29.78	0.2521
# of items	2.07	0.6778	1.754	2.079	0.7592	1.555	2.071	0.6707	1.558
Length	8,017	412,000K	6.587	8,258	451,000K	10.46	8,017	569,000K	15.36
Inst. own.	0.537	0.1234	-0.2198	0.5411	0.1232	-0.2549	0.5369	0.124	-0.2291
# Analysts	5.909	45.83	1.518	6.259	51.49	1.462	5.909	47.84	1.513
10-day	-0.003389	0.01828	2.699	-0.005062	0.02133	4.224	-0.00339	0.02257	4.987
Monday	0.2096	0.1657	1.427	0.2074	0.1644	1.443	0.2096	0.1657	1.427
Tuesday	0.2116	0.1668	1.412	0.201	0.1606	1.492	0.2116	0.1668	1.412
Wednesday	0.2132	0.1678	1.4	0.2021	0.1612	1.484	0.2132	0.1678	1.4
Thursday	0.217	0.1699	1.373	0.1997	0.1598	1.503	0.217	0.1699	1.373
January	0.08207	0.07534	3.045	0.08018	0.07375	3.092	0.08207	0.07534	3.045
February	0.08275	0.07591	3.029	0.08502	0.07779	2.976	0.08275	0.0759	3.029
March	0.08139	0.07477	3.062	0.07952	0.0732	3.108	0.08139	0.07477	3.062
April	0.09092	0.08266	2.846	0.0938	0.085	2.787	0.09092	0.08265	2.846
May	0.0809	0.07436	3.074	0.08712	0.07954	2.928	0.0809	0.07436	3.074
June	0.06748	0.06294	3.448	0.06549	0.0612	3.513	0.06748	0.06293	3.448
July	0.07594	0.07018	3.202	0.07446	0.06892	3.242	0.07594	0.07018	3.202
August	0.08683	0.0793	2.935	0.08422	0.07713	2.994	0.08683	0.0793	2.935
September	0.0882	0.08042	2.904	0.0883	0.08051	2.902	0.0882	0.08042	2.904
October	0.09131	0.08298	2.838	0.08855	0.08071	2.897	0.09131	0.08297	2.838
November	0.1024	0.09192	2.623	0.1018	0.09145	2.633	0.1024	0.09191	2.623
2004	0.1747	0.1442	1.713	0.1573	0.1325	1.883	0.1747	0.1442	1.713
2005	0.158	0.1331	1.875	0.1513	0.1284	1.947	0.158	0.133	1.875
2006	0.1514	0.1285	1.945	0.1479	0.126	1.984	0.1514	0.1285	1.945
2007	0.1328	0.1152	2.164	0.1376	0.1187	2.103	0.1328	0.1152	2.164
2008	0.1266	0.1106	2.246	0.1249	0.1093	2.269	0.1266	0.1106	2.246
2009	0.1027	0.09215	2.618	0.1199	0.1056	2.339	0.1027	0.09214	2.618
2010	0.09889	0.08912	2.687	0.1117	0.09922	2.466	0.09889	0.08912	2.687

TABLE A.9

Price formation without matching

Panel A (Panel B) displays the returns at different horizons of filings that have a positive (negative) return after 10 days. All returns are measured from market closure of the session previous to the news release. High-attention filings correspond to those filed 4:30–5:29 pm. Low-attention filings correspond to those filed 5:30–6:00 am. Filings from 5:30 to 5:34 pm are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Conditioning on return after 10 days being positive

	(1)	(2)	(3)	(4)	(5)	(6)
Return % →	Opening	1 day	2 days	3 days	5 days	10 days
High-attention filings	0.00617***	0.0126***	0.0206***	0.0279***	0.0420***	0.0761***
4:30 pm–5:29 pm	(0.000685)	(0.000750)	(0.000862)	(0.000956)	(0.00107)	(0.00116)
Low-attention filings	0.00425***	0.0101***	0.0193***	0.0265***	0.0406***	0.0760***
5:30 pm–6:00 am	(0.000932)	(0.00104)	(0.00131)	(0.00137)	(0.00155)	(0.00175)
Difference in returns	-0.00193*	-0.00252**	-0.00124	-0.00143	-0.00138	-4.81e-05
	(0.00116)	(0.00128)	(0.00157)	(0.00167)	(0.00188)	(0.00210)
Relative difference %	31.3%	20.0%	6.0%	5.1%	3.3%	0.6%
N	22,148	22,148	22,148	22,148	22,148	22,148

Panel B: Conditioning on return after 10 days being negative

	(1)	(2)	(3)	(4)	(5)	(6)
Return % →	Opening	1 day	2 days	3 days	5 days	10 days
High-attention filings	-0.00311***	-0.0121***	-0.0203***	-0.0279***	-0.0435***	-0.0814***
4:30 pm–5:29 pm	(0.000261)	(0.000371)	(0.000459)	(0.000521)	(0.000626)	(0.000751)
Low-attention filings	-0.00101**	-0.00921***	-0.0182***	-0.0272***	-0.0424***	-0.0808***
5:30 pm–6:00 am	(0.000432)	(0.000609)	(0.000822)	(0.000946)	(0.00113)	(0.00142)
Difference in returns	-0.00210***	-0.00290***	-0.00209**	-0.000711	-0.00113	-0.000583
	(0.000505)	(0.000713)	(0.000941)	(0.00108)	(0.00129)	(0.00161)
Relative difference %	68.0%	24.2%	11.0%	3.4%	3.5%	0.8%
N	22,961	22,961	22,961	22,961	22,961	22,961

TABLE A.10

OTC

Panel A (Panel B) displays the returns at different horizons of filings that have a positive (negative) return after 10 days, separately for pre-cutoff and post-cutoff filings, and the difference between the two samples, for a subsample of filings with OTC price data. High-attention filings correspond to those filed 4:30–5:29 pm. Low-attention filings correspond to those filed 5:30 pm–6:00 am. In Column 1, returns are measured from market closure of the session previous to the news release up to 6:00am on the next day. In all other columns, returns are measured from market closure of the session previous to the news release up to the period indicated in the caption. Sample characteristics are matched by reweighting low-attention filings using entropy matching to match the first, second, and third moments of Fog, the number of items, the length of the filing, the day of the week, the year, the filing item, and Fama-French 49 industry classification across both subsamples. Filings from 5:30 to 5:34 pm are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Conditioning on return after 10 days being positive

Return % →	to 6am (1)	to open (2)	1 day (3)	2 days (4)	3 days (5)	5 days (6)	10 days (7)
High-attention	0.000138***	0.00778***	0.0151***	0.0239***	0.0320***	0.0474***	0.0857***
4:30 pm–5:29 pm	(4.90e-05)	(0.000937)	(0.00105)	(0.00127)	(0.00140)	(0.00157)	(0.00165)
Low-attention filings	-1.69e-05	0.00543***	0.0115***	0.0219***	0.0297***	0.0469***	0.0857***
5:30 pm–6:00 am	(1.88e-05)	(0.00150)	(0.00164)	(0.00200)	(0.00207)	(0.00239)	(0.00263)
Difference in returns	0.000155***	0.00235	0.00361*	0.00206	0.00222	0.000445	-3.28e-05
	(5.25e-05)	(0.00177)	(0.00195)	(0.00237)	(0.00250)	(0.00286)	(0.00311)
Relative difference	112%	30.2%	23.9%	8.8%	6.9%	0.9%	0.0%
N	13,733	13,733	13,733	13,733	13,733	13,733	13,733

Panel B: Conditioning on return after 10 days being negative

Return % →	to 6am (1)	to open (2)	1 day (3)	2 days (4)	3 days (5)	5 days (6)	10 days (7)
High-attention filings	9.60e-06	-0.00325***	-0.0139***	-0.0234***	-0.0319***	-0.0490***	-0.0917***
4:30 pm–5:29 pm	(4.39e-05)	(0.000420)	(0.000569)	(0.000695)	(0.000784)	(0.000927)	(0.00108)
Low-attention filings	-1.86e-05	-0.00106**	-0.00993***	-0.0202***	-0.0311***	-0.0493***	-0.0916***
5:30 pm–6:00 am	(1.93e-05)	(0.000502)	(0.000834)	(0.00111)	(0.00128)	(0.00153)	(0.00194)
Difference in returns	2.82e-05	-0.00218***	-0.00402***	-0.00322**	-0.000848	0.000316	-7.63e-05
	(4.80e-05)	(0.000654)	(0.00101)	(0.00131)	(0.00150)	(0.00179)	(0.00221)
Relative difference %	-294%	67.1%	28.9%	13.8%	1.3%	0.6%	0.1%
N	14,989	14,989	14,989	14,989	14,989	14,989	14,989

TABLE A.11

Price formation after complex news

The sample used in this table is the subset of filings with their average Fog score, number of filings and length above median. Panel A (Panel B) displays the returns at different horizons of filings that have a positive (negative) return after 10 days. All returns are measured from market closure of the session previous to the news release, up the period given in the caption. High-attention filings correspond to those filed 4:30–5:29 pm. Low-attention filings correspond to those filed 5:30–6:00 am. Sample characteristics are matched by reweighting low-attention filings using entropy matching to match the first, second, and third moments of Fog, the number of items, the length of the filing, the day of the week, the year, the filing item, and Fama-French 49 industry classification across both subsamples. Filings from 5:30 to 5:34 pm are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Conditioning on return after 10 days being positive

	(1)	(2)	(3)	(4)	(5)	(6)
Return % →	Opening	1 day	2 days	3 days	5 days	10 days
High-attention filings	0.00747***	0.0137***	0.0223***	0.0302***	0.0457***	0.0793***
4:30 pm–5:29 pm	(0.00123)	(0.00133)	(0.00151)	(0.00170)	(0.00203)	(0.00217)
Low-attention filings	0.00379***	0.00849***	0.0172***	0.0240***	0.0397***	0.0780***
5:30 pm–6:00 am	(0.000722)	(0.00105)	(0.00140)	(0.00162)	(0.00224)	(0.00287)
Difference in returns	-0.00367***	-0.00519***	-0.00513**	-0.00624***	-0.00590*	-0.00137
	(0.00143)	(0.00169)	(0.00206)	(0.00235)	(0.00302)	(0.00360)
Relative difference %	49.1%	37.9%	23.3%	20.7%	13.1%	1.7%
N	7,288	7,288	7,288	7,288	7,288	7,288

Panel B: Conditioning on return after 10 days being negative

	(1)	(2)	(3)	(4)	(5)	(6)
Return % →	Opening	1 day	2 days	3 days	5 days	10 days
High-attention filings	-0.00324***	-0.0139***	-0.0231***	-0.0317***	-0.0479***	-0.0862***
4:30 pm–5:29 pm	(0.000574)	(0.000835)	(0.00102)	(0.00119)	(0.00138)	(0.00160)
Low-attention filings	-0.000848	-0.00976***	-0.0202***	-0.0301***	-0.0452***	-0.0858***
5:30 pm–6:00 am	(0.00104)	(0.00115)	(0.00154)	(0.00182)	(0.00208)	(0.00280)
Difference in returns	-0.00239**	-0.00418***	-0.00292	-0.00159	-0.00267	-0.000363
	(0.00119)	(0.00142)	(0.00185)	(0.00218)	(0.00250)	(0.00323)
Relative difference %	73.8%	30.1%	12.6%	5.0%	5.6%	0.4%
N	7,384	7,384	7,384	7,384	7,384	7,384

TABLE A.12

Price formation after non-complex filings

The sample used in this table is the subset of filings with their average Fog score, number of filings, or length below the median. Panel A (Panel B) displays the returns at different horizons of filings that have a positive (negative) return after 10 days. All returns are measured from market closure of the session previous to the news release. High-attention filings correspond to those filed 4:30–5:29 pm. Low-attention filings correspond to those filed 5:30–6:00 am. Sample characteristics are matched by reweighting low-attention filings using entropy matching to match the first, second, and third moments of Fog, number of items, length of the filing, day of the week, year, filing item, and Fama-French 49 industry classification across both subsamples. Filings from 5:30 to 5:34 pm are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Conditioning on return after 10 days being positive

	(1)	(2)	(3)	(4)	(5)	(6)
Return % →	Opening	1 day	2 days	3 days	5 days	10 days
High-attention filings	0.00548***	0.0121***	0.0200***	0.0268***	0.0405***	0.0746***
4:30 pm–5:29 pm	(0.000795)	(0.000936)	(0.00118)	(0.00130)	(0.00145)	(0.00151)
Low-attention filings	0.00447***	0.0109***	0.0204***	0.0278***	0.0410***	0.0751***
5:30 pm–6:00 am	(0.00134)	(0.00146)	(0.00182)	(0.00188)	(0.00203)	(0.00220)
Difference in returns	0.00101	0.00126	-0.000404	-0.000929	-0.000514	-0.000517
	(0.00156)	(0.00173)	(0.00217)	(0.00228)	(0.00249)	(0.00267)
Relative difference %	18.4%	9.9%	-2.0%	-3.4%	-1.3%	-0.7%
N	14,860	14,860	14,860	14,860	14,860	14,860

Panel B: Conditioning on return after 10 days being negative

	(1)	(2)	(3)	(4)	(5)	(6)
Return % →	Opening	1 day	2 days	3 days	5 days	10 days
High-attention filings	-0.00309***	-0.0119***	-0.0197***	-0.0269***	-0.0418***	-0.0786***
4:30 pm–5:29 pm	(0.000342)	(0.000470)	(0.000573)	(0.000643)	(0.000773)	(0.000917)
Low-attention filings	-0.00109***	-0.00896***	-0.0174***	-0.0259***	-0.0411***	-0.0785***
5:30 pm–6:00 am	(0.000415)	(0.000715)	(0.000969)	(0.00110)	(0.00134)	(0.00162)
Difference in returns	-0.00200***	-0.00289***	-0.00231**	-0.00102	-0.000676	-9.40e-05
	(0.000538)	(0.000856)	(0.00113)	(0.00127)	(0.00154)	(0.00186)
Relative difference %	64.7%	24.3%	11.7%	3.8%	1.6%	0.1%
N	15,577	15,577	15,577	15,577	15,577	15,577

TABLE A.13

Robustness

This table shows estimates for the difference at cutoff (post-5:30 minus pre-5:30 pm) from local linear regressions with an optimal bandwidth defined as in Calonico, Cattaneo, and Farrell (2020). Panel A contains only 8-K/A filings; Panel B splits the sample between filings with or without press releases; Panel C splits the sample between filings up to one calendar day after the event and those filed more than five days after the event; and Panel D excludes "other events". The dependent variables are: "# Items," the number of different items filed within one filing; "Length," the word count of all documents in the filing; and "Fog," the Fog index of text readability. Filings from 5:30 to 5:34 pm are excluded. *** p<0.01, ** p<0.05, * p<0.1.

Panel A. Amendments

	(1) # Items	(3) Total length	(4) Fog (avg.)
Post- minus pre-	0.0572	-1,312	0.408
p-value	0.733	0.594	0.668
Bandwidth (in % of h)	52.520	41.820	75.279
N within	1,577	1,278	1,566

Panel B. Press releases

	# Items		Total length		Fog (avg.)	
	(1)	(2)	(3)	(4)	(5)	(6)
Sample →	With press release	Without press release	With press release	Without press release	With press release	Without press release
Post- minus pre-	-0.339***	-0.256***	-4,636***	-4,409***	-1.297***	-0.107
p-value	0.000	0.000	0.000	0.000	0.001	0.736
Difference	-0.083		-227		-1.19	
t-stat	-1.20		-0.21		-2.83	
Bandwidth (% of h)	41.594	31.816	41.247	31.181	45.169	62.632
N within	12,517	17,502	12,349	16,950	13,162	23,992

Panel C: Calendar days since event day

	# Items		Total length		Fog (avg.)	
	(1)	(2)	(3)	(4)	(5)	(6)
Sample →	1	>5	1	>5	1	>5
Post- minus pre-	-0.208***	-0.251**	-3,472***	-5,868**	-0.933***	-0.169
p-value	0.000	0.023	0.000	0.011	0.008	0.786
Difference	0.043		2396		-0.764	
t-stat	0.37		0.99		-1.07	
Bandwidth (% of h)	39.426	46.020	46.000	31.772	49.461	37.775
N within	12,887	5,966	14,722	4,167	13,702	3,941

Panel D. Excluding "other events"

	(1) # Items	(2) Total length	(3) Fog (avg.)
Post- minus pre-	-0.201***	-4,895***	-0.256
p-value	0.000	0.000	0.365
Bandwidth (in % of h)	35.182	30.625	49.338
N within	19,655	17,140	22,185