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Published in:
Contemporary Accounting Research

Published: 01/01/2022

Document Version:
Final Published version, also known as Publisher's PDF, Publisher's Final version or Version of Record

Publication record in CityU Scholars:
Go to record

Published version (DOI):
10.1111/1911-3846.12756

Publication details:
LI, X., & TAN, Q. (2022). Asymmetric Inefficiency in the Market Response to Non-earnings 8-K Information. *Contemporary Accounting Research*, *39*(2), 1389-1424. https://doi.org/10.1111/1911-3846.12756

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Asymmetric Inefficiency in the Market Response to Non-earnings 8-K Information*

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ABSTRACT

This paper examines the pricing efficiency of 8-K filings for events other than earnings announcements. Since these filings provide timely information that is material to investors and explain variations in quarterly returns to a degree similar to other disclosures, understanding how the stock price absorbs their information is important for investors, regulators, and academics. By testing the statistical correlation between the immediate stock returns in response to these filings and subsequent stock returns before, during, and after the forthcoming earnings announcement, we find evidence of investor overreaction to good news but underreaction to bad news in the immediate window. Essentially, the price increases too much for good news but fails to decrease enough for bad news, resulting in overpricing for both. Most of the correction for this overpricing occurs in the period leading up to the forthcoming earnings announcement, while the rest happens during the announcement. Drawing on Miller (1977), we further illustrate that, in the presence of short-sale constraints, increase in investor disagreement spurred by interpretation difficulty is the most likely mechanism for the observed overpricing. We fail to find sufficient evidence in support of alternative mechanisms, including managerial disclosure strategies, analyst optimistic bias, and retail investor participation. This asymmetric mispricing for non-earnings 8-Ks contrasts with the symmetric mispricing commonly found for other types of disclosures, where investors either systematically underreact or overreact to public information. Our results could broadly speak to the pricing of other public information that is inherently difficult to interpret.

Keywords: 8-K filings, inefficiency, overpricing, interpretation difficulty, disagreement, short-sale constraints

*Accepted by Partha Mohanram. We thank Partha Mohanram, Alan Webb, and two anonymous referees for their valuable feedback throughout the review process. We appreciate helpful comments from Jake Thomas, Frank Zhang, Alina Lerman, Kalin Kolev, Haibin Wu, Ke Wang, Siew Hong Teoh, Ben Lourie, Bobby Stoumbos, John Heater, Zeqiong Huang, Thomas Steffen, Rick Antle, Shyam Sunder, Tim Gray (copyeditor), Hal White, Luo Zuo, Vivian Fang, Todd Kravet, Sunny Yang, Frank Murphy, Steven Utke, Philip Shane, Denise Jones, Kim Smith, Mark Bradshaw, Amy Hutton, Dmitri Byzalov, Russell Lundholm, Ira Yeung, Jeong-Bon Kim, Yuyan Guan, Wen Chen, Zheng Wang, Yangyang Chen, Jinzhi Lu, Jun Chen, and workshop participants at the Yale SOM Fall Accounting Conference 2017, the AAA PhD Rookie Camp 2017, the College of William and Mary, the University of California, Irvine, the University of Connecticut, City University of Hong Kong, Tianjin University, Sun Yat-Sen University, and Xi'an Jiaotong University. We also thank Google Trends for generously providing academic access to the daily search volume index. Dr. Xing Li acknowledges the financial supports from China Postdoctoral Science Foundation (Program 2021M692542). All errors and omissions are our own.

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Contemporary Accounting Research Vol. 39 No. 2 (Summer 2022) pp. 1389–1424 © CAAA
doi:10.1111/1911-3846.12756

L'inefficacité asymétrique de la réaction du marché à l'information 8-K non liée aux résultats

RÉSUMÉ

Cet article examine l'efficacité des tarifications établies à partir des formulaires 8-K pour les événements autres que les annonces de résultats. Puisque ces formulaires fournissent des informations précises et essentielles pour les investisseurs expliquant les écarts dans les rendements trimestriels à un niveau comparable à d'autres divulgations, il est important pour les investisseurs, les régulateurs et les universitaires de comprendre comment le cours des actions absorbe ces informations. En testant la corrélation statistique entre le rendement immédiat des actions en réponse à ces formulaires et leur rendement ultérieur avant, pendant et après la prochaine annonce des résultats, les auteurs relèvent des données relatives à la sur-réaction des investisseurs aux bonnes nouvelles, mais à la sous-réaction aux mauvaises nouvelles dans la fenêtre immédiate. Essentiellement, le prix augmente trop pour les bonnes nouvelles, mais ne diminue pas assez pour les mauvaises, ce qui entraîne une surévaluation pour les deux. La majeure partie de la correction de cette surévaluation se produit dans la période précédant la prochaine annonce des résultats, tandis que le reste se produit pendant l'annonce. En s'inspirant de Miller (1977), les auteurs illustrent en outre qu'en présence de contraintes liées aux ventes à découvert, l'augmentation du désaccord des investisseurs, favorisée par la difficulté d'interprétation, est le mécanisme le plus probable de la surévaluation observée. Les auteurs ne trouvent pas de preuves suffisantes à l'appui d'autres mécanismes, notamment les stratégies de divulgation des gestionnaires, le biais optimiste des analystes et la participation des investisseurs de détail. Cette erreur d'évaluation asymétrique des 8-K non liés aux résultats contraste avec l'erreur d'évaluation symétrique que l'on trouve généralement pour d'autres types de divulgations, où les investisseurs sous-réagissent ou surréagissent systématiquement aux informations publiques. Les résultats de l'étude pourraient s'appliquer de manière générale à l'évaluation d'autre information publique difficile à interpréter.

Mots-clés : formulaires 8-K, inefficacité, surévaluation, difficulté d'interprétation, désaccord, contraintes liées aux ventes à découvert

1. Introduction

The Securities Act of 1934 requires firms to disclose material corporate events by filing Form 8-K with the SEC. In 2004, the filing deadline for most types of events was shortened to four business days after the event and the scope of reportable events was expanded to 22 types, including earnings announcements (SEC 2004). The aim of the requirement is to ensure that investors are promptly informed of material corporate events. Prior studies have concluded that, consistent with this purpose, non-earnings 8-Ks provide timely information that is material to investors (Lerman and Livnat 2010; McMullin et al. 2019; Noh et al. 2019) and explain variations in quarterly returns to a degree similar to other disclosures, such as management earnings forecasts (Ma 2019). The objective of this paper is twofold. First, we examine the pricing efficiency of non-earnings 8-Ks by testing the statistical correlation between the immediate and subsequent price responses before, during, and after the forthcoming earnings announcement. Second, we explore the mechanism underlying the potential mispricing.

While price underreaction to earnings announcements is well documented (Ball and Brown 1968; Foster et al. 1984; Bernard and Thomas 1989), research on the pricing efficiency of non-earnings 8-Ks is limited. For many types of events, Lerman and Livnat (2010) find significant stock returns around the date of the event, the date of the filing disclosing that event, and in subsequent windows. However, since their focus is not on pricing efficiency, these authors do not test the statistical relationship between the immediate and subsequent returns. For a specific type of *negative* event—non-reliance on previously issued financial statements—Feldman et al. (2008) find

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negative immediate and subsequent returns over 43 trading days after the disclosure. For another type of *negative* event—the resignation of an independent director—Bar-Hava et al. (2018) find that investors underreact to 8-K disclosures, probably because directors obfuscate the reasons for their departure. Motivated by the overall importance of non-earnings 8-Ks in price formation (Lerman and Livnat 2010; Ma 2019; McMullin et al. 2019) and especially the lack of evidence on the pricing efficiency for *positive* 8-K news, this study comprehensively investigates the pricing efficiency of these disclosures for *all* types of events and separately analyzes good and bad news.

More importantly, this study is motivated by the possibility that, because of the special features of non-earnings 8-Ks, the pattern of their potential mispricing may not necessarily be the same as that of the well-known underreaction to earnings announcements (Ball and Brown 1968; Foster et al. 1984; Bernard and Thomas 1989). Non-earnings 8-Ks are unanticipated and describe sporadic events, and they do not directly indicate performance. Compared with earnings announcements, which are anticipated and do quantify performance, non-earnings 8-Ks are harder to interpret (Rubin et al. 2017). Given this difficulty, theoretically, the potential pattern of mispricing for non-earnings 8-Ks might be either *symmetric* or *asymmetric* across good and bad news. On the one hand, since the interpretation difficulty may increase challenges to attention or costs of information processing, investors may underreact to non-earnings 8-K news, regardless of whether the news is good or bad (Bloomfield 2002; Hirshleifer and Teoh 2003; Miao et al. 2016), demonstrating a *symmetric* pattern of mispricing. On the other hand, through two potential mechanisms, investors may overreact to good news but underreact to bad, exhibiting an *asymmetric* pattern of mispricing. The first mechanism is that, as the interpretation difficulty stimulates disagreement among investors, overpricing may occur in the presence of short-sale constraints (Miller 1977). Such constraints prevent some pessimistic investors from trading, so the price does not reflect their valuations, but only those of optimistic and participating pessimistic investors, and ends up being too high. Essentially, the price increases too much for good news (i.e., overreacts) but fails to decrease enough for bad (i.e., underreacts) in the immediate window. The second mechanism is that, as investors have difficulty in interpreting non-earnings 8-Ks, they would also be less able to identify any corresponding disclosure bias, thus allowing additional room for managers to strategically achieve more positive (less negative) price reactions for good (bad) news, introducing overreaction (underreaction).

To empirically test which pattern of potential mispricing is better supported by the data, we first classify 8-K filings as good versus bad news based on the sign of the immediate stock returns from one trading day before the date of the event to one trading day after the date the 8-K is filed. We then test, separately for good and bad news filings, the statistical relationship between the immediate returns and the returns over subsequent periods before, during, and after the firm's forthcoming informative disclosure—the earnings announcement. Our results are consistent with an asymmetric pattern: price overreacts to good news but underreacts to bad news in the immediate window (i.e., overpricing for both). The correction of the overpricing occurs in the period before and during the forthcoming earnings announcement but not afterward. In other words, prices seem to be fully corrected at the time of the announcement. For good news filings, we find that 12.57% of the initial positive response reverses over time, with 10.94% and 1.09% reversing before and during the earnings announcement, respectively. For bad news filings, we find that 13.98% of the initial negative response drifts into the future, with 9.69% and 3.77% drifting before and during the earnings announcement, respectively. We show that the concentration of price correction before the announcement is likely due to investors obtaining more public information or privately producing more information during this period.

Furthermore, we investigate the most likely mechanism for the observed overpricing. We find that it most consistently increases with the two overpricing drivers suggested by Miller (1977): increase in disagreement and short-sale constraints. However, we fail to find sufficient evidence in support of managerial disclosure strategies (through tone, bundling, timing, readability, or uncertainty) being responsible for the observed mispricing. Although we find limited evidence for

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a weaker overreaction to good news disclosed with more words that indicate uncertainty and for a stronger underreaction to bad news disclosed during lower-attention periods, none of the disclosure strategies is correlated with both overreaction to good news and underreaction to bad news. Also, when we measure immediate response as returns around the event date *before* investors see the disclosure, we find that the overpricing continues to exist with a similar magnitude and thus is unlikely to be mostly driven by disclosure strategies.

We also examine two other alternative mechanisms of overpricing that are *not specific to* the pricing of non-earnings 8-Ks but may theoretically play a role. First, influenced by the optimism of sell-side analysts (Lin and McNichols 1998; Hong and Kubik 2003; O'Brien et al. 2005), investors may interpret non-earnings 8-Ks too positively. However, we find that the overpricing exists with a similar magnitude in a subsample of stocks without analyst coverage and in a subsample of filings for which no analysts update their forecasts within three days after the filing date. Second, if retail investors actively trade on non-earnings 8-K news, they may contribute to the overpricing, as they are net buyers of securities and typically do not sell short (Barber and Odean 2007; Barber et al. 2009). However, we find that the overpricing does not increase with abnormal trading or attention from retail investors. Taken together, our results suggest that Miller's (1977) supposition is the most likely mechanism for the observed overpricing.

The contribution of our paper is twofold. First, the 8-K literature has only provided evidence of investor underreaction to certain types of a priori negative 8-K events (Feldman et al. 2008; Bar-Hava et al. 2018); we contribute to this literature by illuminating the potential pricing inefficiency for positive 8-K news, using a comprehensive sample covering all types of events. By allowing the direction of potential mispricing to differ for good and bad news, we reveal an asymmetry in the pricing of non-earnings 8-Ks: overreaction to good news but underreaction to bad news. This asymmetry is a novel finding, as an extensive literature shows symmetric inefficiency for good and bad news in the same setting.[1] Notably, Frank and Sanati (2018) also document an asymmetric inefficiency pattern but for news articles on S&P 500 firms published by the *Financial Times*, which they attribute to retail investor participation. Our paper differs from theirs because of two key findings. First, in our setting, overpricing exists with a similar magnitude if we use returns around the event date as a measure of immediate responses, which are mostly driven by informed institutional investors (Callen et al. 2019; Ben-Rephael et al. 2019). Second, as mentioned above, overpricing in our setting does not increase with abnormal retail trading or attention.

We also provide cross-sectional evidence consistent with the two Miller (1977) drivers interactively causing overpricing for non-earnings 8-Ks. This result not only complements the findings of Rubin et al. (2017) by showing how interpretation difficulty affects mispricing but also highlights the usefulness of Miller (1977) in explaining mispricing in response to financial disclosures. Although the negative relationship between investor disagreement and future stock returns modeled by Miller (1977) has been confirmed elsewhere (Diether et al. 2002; Chang et al. 2020), prior studies have only examined disagreement in general, whereas we focus on the change in disagreement stimulated by financial disclosures. Thus, our result broadly speaks to the pricing of other public information that is inherently difficult to interpret.

2. Background, prior studies, and hypothesis development

Background and prior studies

In addition to periodic 10-K/Q filings, which comprehensively depict firms' financing, operations, and investments, the Securities Act of 1934 requires firms to promptly disclose material events

1. For example, studies find that prices underreact to earnings announcements (Ball and Brown 1968; Foster et al. 1984; Bernard and Thomas 1989), 10-K filings (You and Zhang 2009), and analyst forecast revisions (Gleason and Lee 2003) but overreact to unexpected and dramatic news (DeBondt and Thaler 1985), accounting accruals (Sloan 1996), past performance (Lakonishok et al. 1994), and peer firms' earnings news (Thomas and Zhang 2008).

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through 8-K filings. Initially, 8-Ks were required to be filed with the SEC no later than 10 days after the end of the month in which a pertinent event occurred. In 1989, the deadline was advanced to 5–15 days after the event itself (SEC 1989). Finally, effective August 23, 2004, the SEC further shortened the filing deadline for most events to four business days after their occurrence. This change came in response to section 409 of the Sarbanes-Oxley Act of 2002, which mandates rapid and current disclosure of material changes to firms (SEC 2004). Prior to 2004, 12 types of events had to be disclosed through 8-Ks; the regulatory change expanded this number to 22, including entry into or termination of a material agreement, creation or increase of an off-balance-sheet obligation, exit or disposal activities, material impairments, etc. To the extent that these events arise sporadically, non-earnings 8-K filings are largely unanticipated by investors (Rubin et al. 2017).

Regarding the informativeness of 8-K filings, prior studies show that, consistent with the purpose of the regulation, they provide timely information that is material to investors, especially since the 2004 regulatory change. For example, Lerman and Livnat (2010) find significant immediate price and volume responses around 8-K disclosures. McMullin et al. (2019) show that more frequent 8-K disclosures improve the speed of price formation over a quarterly reporting cycle, as measured by the area under the cumulative price change curve. Noh et al. (2019) observe that, since the regulatory change, 8-Ks have become a substitute for management guidance and firms have come to rely more on them to convey general types of news, rather than primarily negative news. Ma (2019) estimates that 8-Ks explain variations in quarterly returns to a similar degree as management earnings forecasts, 10-K/Q filings, and operations-related disclosures.

Two recent studies explore trading dynamics around 8-K disclosures. First, Callen et al. (2019, 2) show that, following a "buy on the rumor, sell on the news" strategy, some institutional investors can trade on the leaked sign of news and reverse their position to varying degrees after the filings become public. Second, Ben-Rephael et al. (2019) find that, while institutional investors pay significant attention on both the event and filing dates, retail investors only start to pay attention after increased media coverage on the filing date; thus retail investors end up being exploited by institutional investors, who opportunistically provide liquidity at the filing date. The critical difference between these studies and ours is that, while they focus on the interplay among investors from just before the event date to just after the filing date, we study the collective response by all investors. In other words, we take all investors together, use buy-and-hold stock returns in the immediate window as a measure of their collective response, and examine the relationship between their immediate and future responses to assess pricing efficiency.

Hypothesis development

Because non-earnings 8-Ks are sporadic and event-based, they are largely unanticipated by investors and do not directly indicate performance. In contrast to earnings announcements, which are anticipated prominent disclosures that deliver numeric measures of performance, non-earnings 8-Ks are more difficult to interpret (Rubin et al. 2017). Being unanticipated aggravates this difficulty, as investors cannot collect supplementary information in advance or seek clarifications from management through follow-up conference calls, as they typically do for earnings announcements. This interpretation difficulty is well illustrated by Rubin et al. (2017), who find that analysts by and large do not revise their forecasts in response to non-earnings 8-Ks, which they conjecture to be due to analysts' inability to interpret the information. They also find that, consistent with this conjecture, analysts who do react to the news have superior interpretation skills, as reflected by higher forecast accuracy. Given this interpretation difficulty, we propose that the potential pattern of mispricing for non-earnings 8-Ks can be either *symmetric* or *asymmetric* across good and bad news.

To elaborate, on the one hand, investors, driven by the interpretation difficulty, may underreact, regardless of whether the non-earnings news is good or bad, demonstrating a *symmetric* pattern of mispricing. Drawing on the insights of Bloomfield (2002), in equilibrium, when there are extra costs to process the information, a higher trading gain is required as compensation, so fewer investors would trade, leading to an incomplete revelation of the information in the price. In

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addition, as suggested by the literature on limited investor attention (Hirshleifer and Teoh 2003; Miao et al. 2016), investors tend to underreact to information that is less salient and harder to process. Non-earnings 8-K information fits this profile.

On the other hand, through two potential mechanisms, investors may overreact to good news but underreact to bad news in non-earnings 8-Ks, exhibiting an *asymmetric* pattern of mispricing. The first mechanism is that non-earnings 8-Ks may stimulate disagreement among investors, and this disagreement, when accompanied by short-sale constraints, may lead to overpricing, whereby the price overreacts to good news but underreacts to bad (Miller 1977). This is because after investors update their valuations based on the 8-K news, pessimistic investors with valuations below the prevailing price would refrain from short-selling because of constraints, but such constraints do not inhibit buying by optimistic investors (i.e., those with valuations above the prevailing price), thus the price would move toward a more optimistic valuation.[2] Assuming that the average valuation of *all* investors is the correct price, which should be the case absent systematic investor mistakes, the updated price that does not reflect the valuations of those non-participating pessimistic investors will be higher than the correct one. Essentially, the price increases too much for good news (i.e., overreacts) but fails to decrease enough for bad (i.e., underreacts) in the immediate window. In this process, the greater the dispersion of investor valuations induced by the news, the more overpricing there is.

To explain why non-earnings 8-K news may increase disagreement among investors, we draw on insights from two streams of theoretical studies. The first stream demonstrates investor differential interpretation of news. For example, Kim and Verrecchia (1994) suggest that, after observing a public signal, investors with superior interpretation skills could form fundamental expectations that are better than those of other investors. In a similar vein, Kandel and Pearson (1995) develop a model in which investors disagree with each other more after a public signal, because of their differences in interpretation. The second stream illustrates that, when investors' valuations are based on their expectations of other investors' valuations, they disagree more with each other after a public signal (Kondor 2012).[3] Based on these models, we argue that, if the public signal itself is more difficult to interpret, as in the case of non-earnings 8-Ks, investors would disagree even more, due to either greater differences in interpretations (first stream) or extra uncertainty in inferring other investors' valuations (second stream).

The second mechanism is that, as investors have difficulty in interpreting non-earnings 8-Ks, they may also be less capable of identifying the corresponding managerial disclosure bias, thus allowing additional room for managers to strategically achieve more positive (less negative) price reactions for good (bad) news. Prior studies document that managers strategically influence 8-K disclosures in a variety of ways, including through timing, classification, and news bundling. For example, Niessner (2015) finds that managers disclose negative 8-K events when investors are distracted, so stock prices underreact. Bird et al. (2018) show that managers misclassify 8-K events to reduce investor attention, especially when the news is negative. Segal and Segal (2016) observe that managers bundle bad with good news in the same 8-K to mitigate negative market reactions. Accordingly, the overpricing of non-earnings 8-Ks may occur under the influence of the following managerial disclosure strategies discussed below.

2. Short-sale constraints prevent some pessimistic investors from selling because when the constraints are strong, the borrowing fees these investors must pay to short-sell are accordingly higher. Thus, when investors' expected trading gain is not enough to cover the borrowing fees, they will not proceed. Empirically, with or without explicitly mentioning investor disagreement or Miller (1977), prior studies have documented consistent evidence in support of the correlation between overpricing and short-sale constraints (Figlewski 1981; Desai et al. 2002; Berkman et al. 2009).
3. When some investors buy stocks knowing that later they will have to sell them to others, they trade on their expectations of the short-term selling price, which is determined by other investors' fundamental valuations. Kondor (2012) illustrates that, when there is a public signal, these investors would use it *in conjunction with* their own private signals to infer other investors' private signals. Therefore, because their private signals differ, their inferences of other investors' private signals and the corresponding fundamental valuations would also differ, and hence, their disagreement increases.

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First, if investors react more favorably to disclosures with more positive tone in other settings, such as 10-K/Q filings and earnings announcements (Feldman et al. 2010; Davis et al. 2012; Huang et al. 2014), for non-earnings 8-K disclosures, managers may use an overly positive tone to achieve the same effect. Second, if managers have incentives to deliver consistently good (inconsistently bad) performance, because such a performance pattern is more likely to be attributed to their ability (bad luck) (Harbaugh et al. 2016), managers may be able to amplify (mitigate) investors' positive (negative) reactions to mandatorily disclosed good (bad) news by bundling it with other voluntarily disclosed good news. Third, if managers strategically time the 8-K disclosures (Segal and Segal 2016), investors may underreact (overreact) to the bad (good) news released during low-(high-)attention times. Fourth, if investors react more strongly to more readable disclosures in other settings, such as 10-K filings and laboratory experiments (Loughran and McDonald 2010; Rennekamp 2012), for non-earnings 8-Ks, managers may achieve overpricing by disclosing good (bad) news with higher (lower) readability or certainty.

In summary, since the above arguments for a symmetric or asymmetric pattern of mispricing are equally compelling, we empirically test which of the following parallel hypotheses is better supported by the data.

HYPOTHESIS 1a (H1a). *Price underreacts to both good and bad non-earnings 8-K news (symmetric pattern).*

HYPOTHESIS 1b (H1b). *Price overreacts to good but underreacts to bad non-earnings 8-K news (asymmetric pattern).*

3. Sample, research design, and descriptive statistics

Sample selection

We start with the universe of 8-Ks in the SEC's EDGAR system filed from 2005 to 2015. We begin our sample period after the 2004 regulatory change to control for the regulatory environment. We obtain filing dates from the headers of complete submission text files by taking the date after the words "filed as of date." We then exclude 8-Ks that contain earnings announcements (Item 2.02) and related financial statements (Item 9.01). To allow for more accurate assessment of immediate market reactions, we follow Segal and Segal (2016) in excluding 8-Ks that are filed on the same day, within three days of each other, or within three days of 10-K/Q filings. We then merge the remaining 8-Ks with the Compustat and CRSP merged database, matching on the firm identifier CIK and the fiscal quarter in which the 8-K is filed. Following the mispricing literature (Livnat and Mendenhall 2006; He and Narayanamoorthy 2020), we further require the stocks to be listed on major exchanges (NYSE, AMEX, and NASDAQ), to have non-missing Global Industry Classification Standard (GICS) code, to have non-missing data to calculate immediate and subsequent returns, to have control variables that are commonly used to predict stock returns, and to have a stock price above one dollar at the beginning of the quarter. Our final sample consists of 248,958 non-earnings 8-Ks filed by 6,311 firms.

Research design

For each 8-K filing, we calculate *RET_8K*, four-factor-adjusted immediate returns from one trading day before the event date to one trading day after the filing date.[4] The one trading-day gap at the start (end) of the window is to accommodate information leakage (digestion). If *RET_8K* is positive (negative), we classify the corresponding 8-K as conveying good (bad) news. We refrain

4. Our results are robust to alternative return benchmarks, including using equal- or value-weighted market returns, size-matched portfolio returns, size- and book-to-market-matched portfolio returns, and the Fama-French three-factor model to adjust raw returns.

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from using nonreturn-based measures, such as textual sentiment, to classify news, because doing so requires additional assumptions, and it is not obvious why such measures would be better than using stock returns. In fact, prior studies show that textual sentiment has low ability to explain abnormal returns for 10-Ks (Loughran and McDonald 2011) or 8-Ks (Segal and Segal 2016). For subsequent returns, we examine stock returns over three windows, which are also adjusted with the four-factor model. The first is *RET_PRE_EA*, stock returns from two trading days after the filing date to two trading days before the forthcoming earnings announcement (Pre-EA window). The second is *RET_EA*, stock returns over three days around the earnings announcement (EA window). The third is *RET_POST_EA*, stock returns from two trading days after the earnings announcement to two trading days before the next announcement (Post-EA window). The Appendix provides definitions of all variables.

To comprehensively investigate pricing efficiency, we test the correlation between the immediate stock returns in response to non-earnings 8-Ks and the subsequent returns. Specifically, we estimate the following model separately for the good and bad news subsamples:

$$Subsequent\ Returns = \alpha + \beta RET\_8K_{ijt} + \sum \gamma Control_{jt-1} + Item\ FE + Industry\ FE + \varepsilon_{ijt}, \quad (1)$$

where for each filing i by firm j in quarter t, the immediate returns is RET_8K_{ijt}, and the subsequent returns are $RET\_PRE\_EA_{ijt}$, RET_EA_{jt}, or $RET\_POST\_EA_{jt}$. A positive (negative) β would suggest systematic price drift (reversal) in subsequent windows, implying that the immediate responses suffer from underreaction (overreaction).[5] We use Fama-Macbeth regressions with Newey-West adjustment for six lags to correct for cross-sectional and time-series dependence. Specifically, we first estimate model (1) for 8-Ks filed within each of the 44 calendar quarters in our sample and then average the estimates over these 44 quarters. Following the mispricing literature (Bernard and Thomas 1990; He and Narayanamoorthy 2020), to mitigate the impact of outliers and facilitate result interpretation and comparison, in all our regressions we transform all the right-hand-side variables into scaled decile ranks that range from −0.5 to 0.5 with a mean of zero. By doing so, the estimate of β can be interpreted as hedge returns from a zero investment strategy of longing the stocks in the highest decile of *RET_8K* and shorting those in the lowest decile of *RET_8K*, which can be compared across different samples.[6] We control for variables that are commonly correlated with future returns, including lagged market capitalization (*SIZE*), lagged book-to-market ratio (*BTM*), six-month price momentum leading up to the beginning of the quarter (*MOM*), lagged earnings change (*EARN_CHANGE*), and lagged accruals from the last quarter (*ACCRUAL*). We also include disclosure item and industry fixed effects to control for pricing mistakes inherent to specific types of events and industries.

Descriptive statistics

Panel A of Table 1 tabulates the frequency and the average *RET_8K* for each type of event separately for good and bad news. To allow for more accurate assessment of *RET_8K* in response to a specific event type, we focus on a subsample of single-item filings for this analysis, because if

5. Strictly speaking, the mere fact that the average immediate and subsequent returns have the same (opposite) signs does not necessarily indicate drift (reversal) for two reasons. First, the directions of the signs cannot suggest whether the magnitudes of the two returns are systematically correlated, but such correlation is needed to infer that the two price reactions relate to each other. In other words, if the two reactions are independent, then the subsequent reaction cannot be considered a *correction* for the immediate reaction. Second, the directions of the signs cannot suggest the sign of the correlation between the two returns. For example, even if the two returns are both negative on average, they can still be negatively correlated, but only a positive correlation can indicate drift.
6. Notably, because the windows for our subsequent returns are not aligned in the calendar time across different 8-Ks, a trading strategy that exploits the mispricing we potentially identify is not implementable. Thus, our decile transformation is mostly for the purpose of facilitating results comparison across different samples.

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TABLE 1
Frequency and average immediate returns for each event type

Panel A: Full sample of single-item filings

		Good news				Bad news			
		Obs.	%	*RET_8K* (%)	*t*-statistics	Obs.	%	*RET_8K* (%)	*t*-statistics
Item 1.01	Entry into a Material Definitive Agreement	12,307	12.80	5.16	78.03	12,597	12.75	−4.69	−82.22
Item 1.02	Termination of a Material Definitive Agreement	458	0.48	5.02	12.86	619	0.63	−6.00	−18.50
Item 1.03	Bankruptcy or Receivership	3	0.00	4.76	1.57	1	0.00	−0.16	—
Item 1.04	Mine Safety	34	0.04	5.56	7.00	45	0.05	−5.35	−6.40
Item 2.01	Completion of Acquisition or Disposition of Assets	995	1.03	4.45	21.46	996	1.01	−4.00	−24.06
Item 2.03	Creation of a Direct/Off-Balance Sheet Financial Obligations	684	0.71	3.30	19.58	692	0.70	−3.73	−18.77
Item 2.04	Increase/Acceleration of a Direct/Off-Balance Sheet Financial Obligations	93	0.10	3.61	9.84	124	0.13	−8.39	−3.63
Item 2.05	Costs Associated with Exit or Disposal Activities	487	0.51	4.93	16.66	491	0.50	−5.33	−18.43
Item 2.06	Material Impairments	140	0.15	4.26	7.60	197	0.20	−5.78	−11.94
Item 3.01	Notice of Delisting . . . Transfer of Listing	792	0.82	7.57	16.97	1,069	1.08	−6.74	−28.81
Item 3.02	Unregistered Sales of Equity Securities	509	0.53	6.31	17.30	587	0.59	−5.97	−19.60
Item 3.03	Material Modification to Rights of Security Holders	105	0.11	5.54	5.55	108	0.11	−6.43	−4.78
Item 4.01	Changes in Registrant's Certifying Accountant	944	0.98	5.09	20.96	997	1.01	−5.27	−26.93
Item 4.02	Non-Reliance on Previously Issued Financial Statements	201	0.21	5.55	11.64	282	0.29	−7.08	−10.75
Item 5.01	Changes in Control of Registrant	63	0.07	7.13	3.73	57	0.06	−4.93	−6.32
Item 5.02	Departure/Election of Directors or Principal Officers	22,566	23.47	4.22	113.35	24,549	24.86	−4.48	−118.09
Item 5.03	Amendments to Articles of Incorporation or Bylaws	2,027	2.11	3.98	31.81	2,171	2.20	−4.62	−32.43
Item 5.04	Suspension of Trading Under Registrant's Employee Benefit Plans	218	0.23	3.21	10.87	190	0.19	−2.54	−11.05
Item 5.05	Amendment to Registrant's Code of Ethics	172	0.18	3.95	9.93	162	0.16	−4.80	−9.46
Item 5.06	Change in Shell Company Status	0	0.00	—	—	2	0.00	−1.27	−2.20
Item 5.07	Submission of Matters to a Vote of Security Holders	4,585	4.77	3.63	39.13	4,822	4.88	−3.41	−51.90

(The table is continued on the next page.)

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TABLE 1 (continued)

Panel A: Full sample of single-item filings

		Good news				Bad news			
		Obs.	%	*RET_8K* (%)	*t*-statistics	Obs.	%	*RET_8K* (%)	*t*-statistics
Item 5.08	Shareholder Director Nominations	15	0.02	4.16	3.14	15	0.02	−2.95	−4.72
Item 7.01	Regulation FD Disclosure	19,670	20.46	3.72	94.31	19,104	19.34	−3.82	−82.48
Item 8.01	Other events	29,074	30.24	4.30	106.87	28,889	29.25	−4.59	−91.24
	Total occurrences	96,142				98,766			

Panel B: Subsample of single-item filings with more extreme immediate returns

		Good news				Bad news			
		Obs.	%	*RET_8K* (%)	*t*-statistics	Obs.	%	*RET_8K* (%)	*t*-statistics
Item 1.01	Entry into a Material Definitive Agreement	8,796	13.73	6.93	81.13	8,963	13.61	−6.30	−85.53
Item 1.02	Termination of a Material Definitive Agreement	327	0.51	6.70	12.94	450	0.68	−7.97	−19.48
Item 1.03	Bankruptcy or Receivership	3	0.00	4.76	1.57	0	0.00	—	—
Item 1.04	Mine Safety	27	0.04	6.83	8.13	36	0.05	−6.56	−6.96
Item 2.01	Completion of Acquisition or Disposition of Assets	705	1.10	5.98	21.99	700	1.06	−5.39	−24.98
Item 2.03	Creation of a Direct/Off- Balance Sheet Financial Obligations	400	0.62	5.11	20.43	430	0.65	−5.56	−19.52
Item 2.04	Increase/Acceleration of a Direct/Off-Balance Sheet Financial Obligations	61	0.10	5.08	11.21	90	0.14	−11.27	−3.59
Item 2.05	Costs Associated with Exit or Disposal Activities	350	0.55	6.57	17.43	351	0.53	−7.13	−19.72
Item 2.06	Material Impairments	76	0.12	7.11	7.81	140	0.21	−7.76	−12.84
Item 3.01	Notice of Delisting . . . Transfer of Listing	616	0.96	9.51	17.32	857	1.30	−8.22	−30.58
Item 3.02	Unregistered Sales of Equity Securities	385	0.60	8.13	18.32	436	0.66	−7.76	−20.77
Item 3.03	Material Modification to Rights of Security Holders	69	0.11	7.99%	5.58	77	0.12	−8.66	−4.73
Item 4.01	Changes in Registrant's Certifying Accountant	670	1.05	6.89	21.75	731	1.11	−6.91	−28.83
Item 4.02	Non-Reliance on Previously Issued Financial Statements	147	0.23	7.30	12.41	219	0.33	−8.93	−11.07

(The table is continued on the next page.)

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TABLE 1 (continued)

Panel B: Subsample of single-item filings with more extreme immediate returns

		Good news				Bad news			
		Obs.	%	*RET_8K* (%)	*t*-statistics	Obs.	%	*RET_8K* (%)	*t*-statistics
Item 5.01	Changes in Control of Registrant	52	0.08	8.51	3.74	38	0.06	−7.04	−6.98
Item 5.02	Departure/Election of Directors or Principal Officers	15,213	23.74	5.90	118.76	16,946	25.73	−6.14	−123.29
Item 5.03	Amendments to Articles of Incorporation or Bylaws	1,338	2.09	5.62	32.46	1,431	2.17	−6.60	−33.61
Item 5.04	Suspension of Trading Under Registrant's Employee Benefit Plans	125	0.20	5.05	11.29	94	0.14	−4.35	−11.49
Item 5.05	Amendment to Registrant's Code of Ethics	111	0.17	5.67	10.31	115	0.17	−6.44	−9.83
Item 5.06	Change in Shell Company Status	0	0.00	—	—	1	0.00	−1.85	—
Item 5.07	Submission of Matters to a Vote of Security Holders	3,115	4.86	5.07	39.34	3,264	4.96	−4.75	−53.98
Item 5.08	Shareholder Director Nominations	12	0.02	4.98	3.16	11	0.02	−3.95	−6.49
Item 7.01	Regulation FD Disclosure	12,463	19.45	5.46	96.52	11,876	18.03	−5.71	−82.87
Item 8.01	Other Events	19,017	29.68	6.20	108.94	18,603	28.25	−6.72	−91.37
	Total occurences	64,078				65,859			

Notes: Focusing on single-item filings, this table reports the frequency and average *RET_8K* for each event type separately for good and bad news, as classified by the sign of *RET_8K*, immediate returns from one trading day before the event date to one trading day after the filing date. Panel A reports for the full sample, and panel B reports for a subsample of filings with more extreme *RET_8K*, which are in the top or bottom quarterly tercile. In both panels, the *t*-statistic tests whether *RET_8K* is significantly different from zero.

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one filing contains multiple items we would be unsure which item the investors were reacting to. Following the literature (Lerman and Livnat 2010; Noh et al. 2019), we regard two-item filings with one item being Item 9.01 "Financial Statements and Exhibits" as single-item filings, because this item is always used to provide exhibits for other items and is almost never filed on its own. In our sample, 78% of the filings are single-item filings. We first observe that, consistent with the notion that non-earnings 8-Ks are generally difficult to interpret (Rubin et al. 2017), the most frequent event types (Item 1.01 "Entry into a Material Definitive Agreement," Item 5.02 "Departure/Election of Directors or Principal Officers," Item 7.01 "Regulation FD Disclosure," and Item 8.01 "Other Events") constitute 87% (untabulated) of our sample, but none of them has a clear a priori indication of the nature of the news. The distribution across good and bad news is fairly balanced for these most frequent event types and for other less frequent event types. This balance suggests that any observed mispricing asymmetry across good and bad news (predicted by H1b) is unlikely to be caused by a specific concentration of event types on either side.

To mitigate the concern that it may be problematic to classify filings with slightly positive (negative) *RET_8K* as good (bad) news filings, in panel B of Table 1 we focus on a subsample of filings with more extreme *RET_8K* that are in the top or bottom quarterly tercile (i.e., omitting the middle tercile). We continue to observe the concentration of a priori unclear items and the relatively balanced distribution across good and bad news within each event type.

Given the existence of certain a priori negative events (Items 1.02, 1.03, 2.04, 2.06, 3.01, 4.01, and 4.02), the overall distribution balance between good and bad news may not seem intuitive.[7] Specifically, in panel A of Table 1 for these events there are 2,631 (untabulated) cases of good news and 3,289 (untabulated) cases of bad news; thus, good news is only 20% less than bad news. Similarly in panel B good news is only 24% (untabulated) less than bad news. There are two reasons why these a priori negative items might experience a positive price response. First, some of them could be used to disclose positive events. For example, for Item 1.02 "Termination of a Material Definitive Agreement," there are situations in which ending a material relationship could benefit the firm such as when the market price of a product rises far above the contracted price. In fact, for Item 4.02 "Non-Reliance on Previously Issued Financial Statements," Callen et al. (2006) show that, due to the presence of income-increasing restatements and restatements due to changes in accounting principles, restatements do not always have negative economic implications and are not necessarily associated with negative market reactions. Second, because stock returns reflect the difference between expectation and realization, if investors expect worse news before the actual disclosure, the disclosure itself might bring about positive returns. For example, for Item 2.06 "Material Impairments," investors may have anticipated a substantial impairment based on recent performance and already pushed the price down by a large amount; thus, if the actual impairment disclosed turns out to be smaller than expected, the price would adjust upward. Therefore, we keep the filings with these a priori negative items in our sample and confirm that, as shown in row (3) of Table 10, all of our results remain almost unchanged if we drop them.

Panel A of Table 2 reports the univariate statistics for the variables used in our main tests separately for good and bad news observations. For the good news observations, while the mean (median) of immediate returns (*RET_8K*) is 4.4% (2.5%), the mean and median of returns before the forthcoming earnings announcement (*RET_PRE_EA*) and during the announcement (*RET_EA*) are all negative, consistent with subsequent price reversal. For the bad news observations, the mean (median) immediate returns (*RET_8K*) are −4.5% (−2.5%), and the mean and median of

7. As we report in supporting information Appendix O1, as an addition to the online article, the overall average returns are indeed significantly negative for most of these events. This Appendix reports the frequency and average immediate returns for each item without distinguishing between good and bad news. For most items, these numbers resemble those in panel C of Table 1 in Segal and Segal (2016).

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TABLE 2
Summary statistics

Panel A: Univariate statistics

	Variables	Obs.	Mean	SD	Percentile				
					10th	25th	50th	75th	90th
Good news	*RET_8K*	123,326	0.044	0.067	0.004	0.010	0.025	0.053	0.101
	RET_PRE_EA	123,326	−0.021	0.205	−0.219	−0.090	−0.007	0.066	0.162
	RET_EA	123,326	−0.005	0.090	−0.093	−0.039	−0.002	0.034	0.083
	SIZE	123,326	6.618	1.951	4.075	5.205	6.583	7.933	9.234
	BTM	123,326	0.611	0.580	0.129	0.279	0.506	0.816	1.187
	MOM	123,326	−0.037	0.324	−0.386	−0.170	−0.015	0.122	0.283
	EARN_CHANGE	123,326	−0.002	0.112	−0.033	−0.007	0.001	0.007	0.029
	ACCRUAL	123,326	−0.015	0.045	−0.055	−0.027	−0.009	0.001	0.021
Bad news	*RET_8K*	125,632	−0.045	0.072	−0.102	−0.053	−0.025	−0.011	−0.004
	RET_PRE_EA	125,632	−0.025	0.216	−0.235	−0.096	−0.008	0.067	0.168
	RET_EA	125,632	−0.006	0.093	−0.099	−0.041	−0.002	0.035	0.085
	SIZE	125,632	6.589	1.940	4.066	5.183	6.542	7.897	9.201
	BTM	125,632	0.607	0.587	0.124	0.276	0.501	0.809	1.186
	MOM	125,632	−0.045	0.332	−0.412	−0.184	−0.020	0.120	0.283
	EARN_CHANGE	125,632	−0.005	0.119	−0.039	−0.009	0.000	0.007	0.028
	ACCRUAL	125,632	−0.015	0.046	−0.055	−0.027	−0.009	0.002	0.022

(The table is continued on the next page.)

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TABLE 2 (continued)

Panel B: Correlation matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Good news									
(1)	*RET_8K*		−0.0475*	−0.0209*	−0.2651*	−0.0154*	−0.0851*	−0.0077*	−0.0772*
(2)	*RET_PRE_EA*	−0.0595*		0.0040	0.0450*	0.0155*	0.0379*	0.0807*	−0.0086*
(3)	*RET_EA*	−0.0256*	−0.0020		0.0396*	−0.0010	0.0232*	0.0040	0.0118*
(4)	*SIZE*	−0.2536*	0.0348*	0.0295*		−0.2487*	0.1408*	0.0040	0.0225*
(5)	*BTM*	0.0703*	0.0112*	0.0010	−0.2593*		−0.2008*	−0.0704*	0.1076*
(6)	*MOM*	−0.1204*	0.0392*	0.0220*	0.1473*	−0.2435*		0.1665*	0.0439*
(7)	*EARN_CHANGE*	−0.0295*	0.0664*	−0.0080*	0.0099*	−0.0976*	0.1642*		0.1712*
(8)	*ACCRUAL*	−0.0796*	0.0137*	0.0000	0.0709*	0.0387*	0.0622*	0.2603*	
Bad news									
(1)	*RET_8K*		0.0472*	0.0345*	0.2547*	0.0182*	0.0953*	0.0546*	0.0801*
(2)	*RET_PRE_EA*	0.0368*		0.0030	0.0446*	0.0203*	0.0274*	0.0766*	−0.0050
(3)	*RET_EA*	0.0329*	0.0000		0.0452*	0.0000	0.0331*	0.0094*	0.0104*
(4)	*SIZE*	0.1979*	0.0377*	0.0322*		−0.2289*	0.1576*	0.0384*	0.0324*
(5)	*BTM*	−0.0368*	0.0116*	−0.0010	−0.2439*		−0.2072*	−0.0982*	0.1004*
(6)	*MOM*	0.1070*	0.0212*	0.0371*	0.1578*	−0.2476*		0.1720*	0.0475*
(7)	*EARN_CHANGE*	0.0710*	0.0412*	−0.0020	0.0352*	−0.1357*	0.1751*		0.1821*
(8)	*ACCRUAL*	0.0840*	0.0110*	0.0050	0.0763*	0.0377*	0.0611*	0.2738*	

Notes: This table reports the summary statistics of our main sample separately for good and bad news observations. All continuous variables except for stock returns are winsorized at the 1st and 99th percentiles within the quarter in which the 8-K is filed. The Appendix provides detailed definitions for all variables. Pearson (Spearman) correlations are below (above) the diagonal. * represents significance level of 1%, using two-tailed *p*-values.

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returns before the forthcoming earnings announcement (*RET_PRE_EA*) and during the announcement (*RET_EA*) are also all negative, consistent with subsequent price drift.

Panel B of Table 2 reports the correlations between our main variables separately for the good and bad news observations. For the good news observations, the correlations between immediate returns, *RET_8K*, and two subsequent returns, *RET_PRE_EA* and *RET_EA*, are both negative, consistent with subsequent price reversal. For the bad news observations, the correlations between these returns are positive, consistent with subsequent price drift.

4. Empirical results

The pattern of potential mispricing

To empirically test whether the pattern of potential mispricing is symmetric (H1a) or asymmetric (H1b), we estimate model (1) separately for the good and bad news subsamples. Table 3 reports the results. Similar to Table 1, we first examine the full sample (columns (1) to (4)) and then focus on a subsample of filings with more extreme immediate returns for a potentially more accurate classification of good versus bad news (columns (5) to (8)).[8]

For our full sample, the coefficient on *RET_8K* is significantly negative for good news filings in columns (1) and (2) and significantly positive for bad news filings in columns (3) and (4). This result suggests that, consistent with H1b, the price overreacts to good news but underreacts to bad, exhibiting an asymmetric pattern of inefficiency and overall overpricing. In terms of the magnitude, for good news filings, because the difference in the mean of *RET_8K* from the top to the bottom decile is 1,828 basis points, the coefficient of −0.020 in column (1) suggests that 10.94% (200/1,828) of immediate returns reverse before the earnings announcement, and the coefficient of −0.002 in column (2) suggests that 1.09% (20/1,828) of immediate returns continue reversing during the announcement. Notably, the contrast between columns (1) and (2) indicates that investors have already corrected 91% (0.02/(0.02 + 0.002)) of the overreaction before they see the earnings. For bad news filings, because the difference in the mean of *RET_8K* from the top decile to the bottom decile is 1,858 basis points, the coefficient of 0.018 in column (3) suggests that 9.69% (180/1,858) of immediate returns drift before the earnings announcement, and the coefficient of 0.007 in column (4) suggests that 3.77% (70/1,858) of immediate returns continue drifting during the announcement. Similar to good news filings, the contrast between columns (3) and (4) indicates that 72% (0.018/(0.018 + 0.007)) of the correction for underreaction is completed before the earnings announcement.

In columns (5) to (8), for the subsamples with more extreme immediate returns, the coefficient on *RET_8K* remains significantly negative (positive) for good (bad) news, which alleviates the concern that the results in columns (1) to (4) are caused by a misclassification of news with immediate returns around zero. We continue to observe a concentration of price correction before the earnings announcement in these columns. Our results are also robust to alternative specifications including OLS regressions with item, industry, and quarter fixed effects as well as combining good and bad news subsamples and interacting the actual immediate returns with an indicator variable that equals one if the returns is negative, and zero otherwise. We tabulate the results for these alternative specifications in supporting information in the online Appendix O3.

The mechanism of overpricing

In this section, we investigate whether either of the two hypothesized overpricing mechanisms is supported by the data: increase in disagreement in the presence of short-sale constraints (Miller 1977) and managerial disclosure strategies.

8. When we regress *RET_POST_EA*, returns from two trading days after this quarter's earnings announcement to two trading days before the next quarter's announcement, on *RET_8K*, the coefficient is not significant for either the good or bad news filings. This result suggests that there is no further price correction beyond this quarter's earnings announcement. We do not tabulate these results to save space, but they are available upon request.

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TABLE 3
The asymmetric mispricing of non-earnings 8-K disclosures

	Full sample				Subsample with more extreme *RET_8K*			
	Good news		Bad news		Good news		Bad news	
	(1) *RET_PRE_EA*	(2) *RET_EA*	(3) *RET_PRE_EA*	(4) *RET_EA*	(5) *RET_PRE_EA*	(6) *RET_EA*	(7) *RET_PRE_EA*	(8) *RET_EA*
RET_8K	−0.020***	−0.002***	0.018***	0.007***	−0.026***	−0.004**	0.017***	0.007***
	(−4.84)	(−2.76)	(3.73)	(5.96)	(−4.87)	(−2.66)	(3.02)	(6.86)
SIZE	0.021	0.009***	0.029**	0.009***	0.017	0.009***	0.028*	0.011***
	(1.66)	(4.93)	(2.19)	(3.27)	(1.13)	(4.21)	(1.94)	(3.79)
BTM	0.022***	0.002	0.022***	0.003	0.024***	0.000	0.025***	0.003
	(8.49)	(1.09)	(5.49)	(1.49)	(7.70)	(0.08)	(6.05)	(1.42)
MOM	0.016**	0.005***	0.006	0.009***	0.019***	0.005***	0.007	0.009***
	(2.68)	(4.74)	(0.90)	(4.99)	(2.73)	(4.12)	(0.79)	(3.85)
EARN_CHANGE	0.053***	−0.001	0.052***	−0.000	0.061***	−0.001	0.059***	−0.000
	(12.62)	(−0.61)	(8.24)	(−0.16)	(12.03)	(−0.44)	(7.46)	(−0.02)
ACCRUAL	−0.012***	0.002	−0.010*	0.001	−0.015***	0.002	−0.012	0.001
	(−3.35)	(1.20)	(−1.76)	(0.90)	(−3.80)	(1.12)	(−1.63)	(0.90)
CONSTANT	−0.027**	−0.005***	−0.029*	−0.007***	−0.031**	−0.006***	−0.034*	−0.008***
	(−2.20)	(−2.78)	(−1.94)	(−3.94)	(−2.20)	(−3.31)	(−1.98)	(−3.68)
Item FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	123,326	123,326	125,632	125,632	82,204	82,204	83,769	83,769
R^2	5.93%	2.21%	6.00%	2.60%	6.82%	2.76%	6.60%	3.32%

Notes: This table reports the estimates from regressing subsequent returns (*RET_PRE_EA* or *RET_EA*) on immediate returns (*RET_8K*). A filing is classified as conveying good (bad) news if *RET_8K* is positive (negative). The Appendix provides detailed definitions for all variables. Columns (1) to (4) report results for the full sample and columns (5) to (8) report results for the subsample of filings with more extreme *RET_8K* that are in the top or bottom quarterly tercile (i.e., omitting the middle tercile). All the right-hand-side variables are transformed into scaled decile ranks that range from −0.5 to 0.5 with a mean of zero. The coefficients are the average estimates over 44 quarters from 2005 to 2015 using Fama-MacBeth regressions. Standard errors are adjusted with Newey-West correction for six lags (*t*-statistics are reported in parentheses). *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively, using two-tailed *p*-values.

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Miller (1977) mechanism

We test the effect of the Miller (1977) mechanism by examining whether the observed overpricing increases with its two drivers: increase in investor disagreement and short-sale constraints. Change in investor disagreement is inherently difficult to measure, so we deploy a battery of proxies. First, assuming that disagreement among analysts is sufficiently correlated with disagreement among investors, we construct two proxies with analyst data: *DISP_CHANGE* and *NO_REACT*. *DISP_CHANGE* is the change in the dispersion of EPS forecasts for the current fiscal year from analysts who have a better record in reacting to non-earnings 8-K news. We focus on these skilled analysts based on the insights from Rubin et al. (2017), who find that only 13.7% of analysts react to non-earnings 8-K news from the event date to three days after the filing date (reaction window).[9] These authors conjecture that the low reaction rate is due to analysts' inability to interpret the information and, consistent with this conjecture, they find that analysts who do react to the news have superior interpretation skills, as reflected by higher forecast accuracy. These insights suggest that, when analysts do not update their forecasts in response to non-earnings 8-Ks, it is not because their opinion stays the same in light of the news, but because they cannot process the news to a degree that allows for forecast revision; thus, forecasts from the skilled analysts who can better process the news may better represent opinions of investors trading on the market.[10,11] *NO_REACT* is the percentage of analysts who do not update their forecasts in the reaction window. Intuitively, because only a minority of skilled analysts reacts to non-earnings 8-Ks, due to the interpretation difficulty, the percentage of analysts who do not react would reflect the degree of this difficulty and the corresponding increase in disagreement. Next, to mitigate the concern that analyst-based measures may not well represent investor disagreement and that the forecast revisions are too infrequent to be attributed to non-earnings 8-Ks, we construct three other proxies for change in disagreement over the immediate window using investor data: (i) *AB_TURN*, abnormal share turnover (Bamber et al. 1997), (ii) *IDO_VOL*, idiosyncratic return volatility (Boehme et al. 2006), and (iii) *OPTIMISM*, investor optimism, based on the PVGO index, which reflects the excess pricing of the growth opportunities relative to existing earning capabilities (Chang et al. 2020).[12]

9. We identify skilled analysts as those with a better record in reacting to non-earnings 8-K news, as reflected by having a higher-than-median cumulative reaction ratio (CRR). Following Rubin et al. (2017), for each analyst following the firm, we construct the CRR as the percentage of non-earnings 8-Ks filed by the firm up to the end of the last fiscal quarter to which he or she reacted by revising the forecast within the reaction window. CRR is by definition an analyst-firm-quarter-specific measure.

10. Based on our discussion, a more direct way of measuring change in disagreement is to first calculate the dispersion of individual forecasts that are actually updated over the reaction window and then use this dispersion to subtract the dispersion of the individual forecasts from the same analysts before the event date. However, because in our sample under 10% of analysts revise their forecasts over the reaction window, the percentage of filings with at least two updated forecasts that allows for the calculation of dispersion is only 9.6%. Therefore, to avoid a great loss of statistical power, we alternatively focus on disagreement in a subgroup of skilled analysts. We confirm that our results remain qualitatively the same if we use the change in the dispersion of consensus forecast as an alternative proxy.

11. To mitigate the concern that the average time between the filing date and the date when the skilled analysts revise their forecasts is too long to ensure that the revisions are indeed based on the 8-K information, in an untabulated analysis, we regress their revision on *RET_8K* or its sign (an indicator variable that equals to one if *RET_8K* is positive, and zero otherwise), controlling for the same set of variables as our main results, including item fixed effects, industry fixed effects, quarter fixed effects, and analyst fixed effects. We cluster the standard errors at the firm level. We observe a significantly positive coefficient (*t*-statistic equals 5.95 for the coefficient on *RET_8K* and 6.34 for the coefficient on its sign), which may suggest that the skilled analysts do eventually use the 8-K information in their immediate next revisions.

12. The potential limitation for these investor-based measures is that their calculation uses stock price or trading volume, which are correlated with immediate returns, and that some of these measures capture other constructs besides disagreement (e.g., liquidity, risk, etc.). Therefore, we regard our analyst-based and investor-based measures as complements and take their results together to make inferences.

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Our proxy for short-sale constraints is *CONSTRAIN*, the daily cost of borrowing score (DCBS) provided by Markit averaged over the immediate window. As suggested by Beneish et al. (2015), because the actual borrowing fee is only available for about 36% of the securities that Markit covers, Markit provides a proprietary measure, DCBS, for all of the securities that it covers as a categorical indication of the actual short-sale costs. Beneish et al. (2015) find that DCBS captures factors of both the supply and demand sides of the securities lending market and thus well reflects short-sale costs.

We regress subsequent returns (*RET_PRE_EA* or *RET_EA*) on immediate returns (*RET_8K*) interacted with these proxies. All the other specifications are the same as model (1). The Miller (1977) mechanism predicts a negative (positive) interaction coefficient for good (bad) news filings. Table 4 reports the coefficient of interest across five alternative proxies for increase in disagreement. We observe that, for good news filings, the overpricing significantly increases with all five proxies when the dependent variable is *RET_PRE_EA* and with *NO_REACT*, *AB_TURN*, and *IDO_VOL* when the dependent variable is *RET_EA*. For bad news filings, the overpricing significantly increases with *DISP_CHANGE*, *AB_TURN*, and *OPTIMISM* when the dependent variable is *RET_PRE_EA* and with *NO_REACT*, *IDO_VOL*, and *OPTIMISM* when the dependent variable is *RET_EA*. These cross-sectional results are generally consistent across different proxies, especially when considering the price correction before earnings announcement, which constitutes a majority of the overall price correction as suggested by Table 3.

Table 5 reports the results for short-sale constraints. We find that overpricing significantly increases with *CONSTRAIN* in all four columns. In an untabulated analysis, we verify our results with three alternative proxies of short-sale constraints over the immediate window: (i) indicative borrowing fee (a proprietary measure of the estimated borrowing fee provided by Markit); (ii) the percentage of shares shorted (Figlewski 1981; Boehme et al. 2006); and (iii) the opposite of the percentage of shares owned by institutional investors (Nagel 2005; Cookson and Niessner 2020). We find that both overreaction to good news and underreaction to bad news significantly increase with all three measures, except for the percentage of shares shorted when the dependent variable is *RET_EA* for good news filings.

Taken together, the cross-sectional results in Tables 4 and 5 provide evidence in support of the Miller (1977) mechanism being an important driver for the observed overpricing.

Managerial disclosure strategies

To test the effect of managerial disclosure strategies, we focus on five specific strategies and regress subsequent returns on immediate returns interacted with their proxies. For this analysis, we use *RET_FILING* (three-day returns around the filing date), rather than *RET_8K* (returns from one day before the event date to one day after the filing date) as immediate returns, because disclosure strategies are invisible to investors until the filing date. Accordingly, we construct good versus bad news subsamples based on the sign of *RET_FILING*. Nevertheless, these disclosure strategies may be correlated with other unobservable managerial efforts to influence investor perceptions before the 8-Ks are filed. To address this concern, we repeat our tests with *RET_8K* and find qualitatively similar results (untabulated). To save space, we summarize our key results in this section and provide a full set of results with detailed discussion in online Appendix O2.

Table 6 reports the interaction coefficients and their expected signs. In row (1), *TONE* is the net percentage of positive words in each 8-K. If managers use an overly positive tone to achieve more favorable price reactions for both good and bad news, we should observe a negative (positive) interaction coefficient for good (bad) news filings. However, the interaction coefficient is only weakly significant in column (1) but with a sign that is opposite to our expectation. In row (2), *BUNDLING* is an indicator variable that equals one if we observe a bundling of mandatory good news with other voluntary good news for good news filings, or a bundling of mandatory bad news with voluntary good news for bad news filings, and zero otherwise. If this bundling boosts (mitigates) investor reactions to good (bad) news filings and thus achieves overreaction

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TABLE 4
Overpricing and change in disagreement

		Good news			Bad news		
			(1) Coefficient on *RET_8K*×Proxy	(2)		(3) Coefficient on *RET_8K*×Proxy	(4)
	Proxies for change in disagreement	Obs.	*Y* = *RET_PRE_EA*	*Y* = *RET_EA*	Obs.	*Y* = *RET_PRE_EA*	*Y* = *RET_EA*
(1)	Change in forecast dispersion among skilled analysts (*DISP_CHANGE*)	74,267	−0.025***	−0.001	75,974	0.017***	0.005
			(−3.64)	(−0.28)		(3.72)	(1.56)
(2)	Percentage of analysts who do not react to 8-K disclosures (*NO_REACT*)	106,407	−0.012***	−0.006***	108,459	−0.002	0.004*
			(−3.48)	(−3.54)		(−0.25)	(1.91)
(3)	Abnormal turnover (*AB_TURN*)	123,326	−0.029***	−0.006*	125,632	0.013**	0.002
			(−8.77)	(−1.88)		(2.14)	(1.38)
(4)	Idiosyncratic return volatility (*IDO_VOL*)	123,326	−0.017**	−0.009***	125,632	0.005	0.010***
			(−2.07)	(−3.57)		(0.51)	(3.47)
(5)	Investor optimism (*OPTIMISM*)	120,898	−0.041***	−0.003	123,270	0.045***	0.015***
			(−5.15)	(−0.61)		(3.38)	(3.44)

Notes: This table reports the coefficients from regressing subsequent returns (*RET_PRE_EA* or *RET_EA*) on immediate returns (*RET_8K*) interacted with alternative proxies for change in disagreement. A filing is classified as conveying good (bad) news if *RET_8K* is positive (negative). The Appendix provides detailed definitions for all variables. All the right-hand-side variables are transformed into scaled decile ranks that range from −0.5 to 0.5 with a mean of zero. The coefficients are the average estimates over 44 quarters from 2005 to 2015 using Fama-MacBeth regressions. Standard errors are adjusted with Newey-West correction for six lags (*t*-statistics are reported in parentheses). *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively, using two-tailed *p*-values.

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TABLE 5
Overpricing and short-sale constraints

	Good news		Bad news	
	(1) *RET_PRE_EA*	(2) *RET_EA*	(3) *RET_PRE_EA*	(4) *RET_EA*
RET_8K	−0.029***	−0.006***	0.026***	0.009***
	(−6.22)	(−2.74)	(5.33)	(3.42)
RET_8K×CONSTRAIN	−0.032***	−0.015***	0.035***	0.012**
	(−5.72)	(−3.42)	(5.26)	(2.59)
CONSTRAIN	−0.024***	−0.009***	−0.022***	−0.010***
	(−4.52)	(−8.02)	(−3.95)	(−8.09)
SIZE	0.009	0.004	0.019	0.005
	(0.71)	(1.58)	(1.40)	(1.58)
BTM	0.018***	−0.001	0.017***	0.000
	(6.53)	(−0.54)	(3.78)	(0.19)
MOM	0.010*	0.005***	0.002	0.008***
	(1.92)	(3.29)	(0.31)	(4.08)
EARN_CHANGE	0.052***	−0.003	0.050***	−0.002
	(11.87)	(−1.68)	(7.20)	(−1.23)
ACCRUAL	−0.011***	0.004**	−0.009	0.002**
	(−3.38)	(2.58)	(−1.54)	(2.15)
CONSTANT	−0.033**	−0.008***	−0.035**	−0.010***
	(−2.34)	(−4.27)	(−2.23)	(−4.57)
Item FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	97,802	97,802	99,139	99,139
R^2	7.00%	2.70%	6.99%	3.20%

Notes: This table reports the estimates from regressing subsequent returns (*RET_PRE_EA* or *RET_EA*) on immediate returns (*RET_8K*) interacted with short-sale constraints (*CONSTRAIN*). A filing is classified as conveying good (bad) news if *RET_8K* is positive (negative). The Appendix provides detailed definitions for all variables. All the right-hand-side variables are transformed into scaled decile ranks that range from −0.5 to 0.5 with a mean of zero. The coefficients are the average estimates over 44 quarters from 2005 to 2015 using Fama-MacBeth regressions. Standard errors are adjusted with Newey-West correction for six lags (*t*-statistics are reported in parentheses). *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively, using two-tailed *p*-values.

(underreaction), we expect a negative (positive) interaction coefficient. However, the interaction coefficient is not significant in any of the four columns. In row (3), *TIMING* is an indicator variable that equals one if the 8-K is filed during the periods when investor attention is supposedly low (i.e., after trading hours or on the last trading day of a week), and zero otherwise. If investors overreact (underreact) to good (bad) news released during high- (low-) attention periods, we should expect a positive interaction coefficient for both good and bad news filings. We observe that the interaction coefficient is weakly significant in column (4), indicating that, although managers could not achieve less negative immediate price reactions by releasing news in low-attention periods (Segal and Segal 2016), those that choose to do so could indeed temporarily delay some of the negative reactions to the earnings announcement. Therefore, for these strategic managers, their stock's total price drop is actually greater, which is consistent with the notion that, when the news is especially negative, managers time its release to avoid a sudden big drop in price. In row (4), *FOG* is the Fog index for the 8-K that reflects its reading difficulty. In row

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TABLE 6
Overpricing and management disclosures strategies

		Good news			Bad news		
			(1) Coefficient on *RET_FILING*×Proxy	(2)		(3) Coefficient on *RET_FILING*×Proxy	(4)
	Proxies for disclosure strategy	Expected sign	*Y* = *RET_PRE_EA*	*Y* = *RET_EA*	Expected sign	*Y* = *RET_PRE_EA*	*Y* = *RET_EA*
(1)	*TONE*	−	0.010*	−0.002	+	0.004	0.000
			(1.96)	(−0.73)		(0.52)	(0.13)
(2)	*BUNDLING*	−	0.026	0.004	+	0.066	0.008
			(0.73)	(0.18)		(1.50)	(0.42)
(3)	*TIMING*	+	0.004	0.001	+	−0.005	0.004*
			(1.02)	(0.67)		(−1.35)	(1.70)
(4)	*FOG*	+	−0.004	−0.001	+	−0.007	0.001
			(−0.77)	(−0.46)		(−1.06)	(0.41)
(5)	*UNCERTAINTY*	+	0.012*	0.002	+	0.003	−0.005
			(1.70)	(1.08)		(0.60)	(−1.56)

Notes: This table reports the coefficients from regressing subsequent returns (*RET_PRE_EA* or *RET_EA*) on immediate returns (*RET_FILING*) interacted with our proxies for five disclosure strategies. A filing is classified as conveying good (bad) news if *RET_FILING* is positive (negative). The Appendix provides detailed definitions for all variables. All the right-hand-side variables are transformed into scaled decile ranks that range from −0.5 to 0.5 with a mean of zero. The coefficients are the average estimates over 44 quarters from 2005 to 2015 using Fama-MacBeth regressions. Standard errors are adjusted with Newey-West correction for six lags (*t*-statistics are reported in parentheses). * represents significance levels of 10%, using two-tailed *p*-values.

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(5), *UNCERTAINTY* is the percentage of words that indicate uncertainty in the 8-K. If investor reactions are stronger for 8-Ks with lower reading difficulty or greater certainty, we expect positive interaction coefficients in these two rows. However, the interaction coefficient is only weakly significant in row (5) and only in column (1), providing limited evidence that good news disclosures with higher language certainty produce greater investor overreaction.

In an untabulated analysis, in rows (3) and (5), we add the Miller (1977) drivers and their interaction with immediate returns to the right-hand side and find that, while the interaction coefficients for the Miller (1977) drivers are still significantly negative (positive) for good (bad) news filings, the weak results for disclosure strategies either disappear or become inconsistent. Specifically, in row (3), the interaction coefficient for *TIMING* in column (4) is no longer significant. In row (5), while the interaction coefficient for *UNCERTAINTY* in column (1) remains significantly positive, it becomes significantly negative in columns (3) and (4) (t-statistic equals −1.82 and −2.12, respectively) with a sign that is opposite to our expectation. Overall, given that none of the five strategies is correlated with *both* overreaction to good news and underreaction to bad news, and that the weak results for timing and language certainty do not hold after controlling for the Miller (1977) drivers, we conclude that managers' influencing investor reactions through disclosure strategies is unlikely to be an important mechanism for the observed overpricing.

Alternative mechanisms

In this section, we empirically test the effect of two alternative mechanisms that may theoretically contribute to overpricing but are not specific to the pricing of non-earnings 8-Ks: influences of analyst optimism and retail investor participation.

Influences of analyst optimism

Prior studies document that analysts have incentives to be overly optimistic about the firms they cover (Lin and McNichols 1998; Hong and Kubik 2003; O'Brien et al. 2005), and thus, their optimism bias may systematically influence investors in interpreting 8-K news. We indirectly investigate this possibility by examining whether the overpricing of non-earnings 8-Ks exists in two subsamples that are less likely to be influenced by analysts. Table 7, panel A, reports our estimates of overpricing for these subsamples.

In row (1), we focus on a subsample of stocks that are not covered by analysts in the sense that no analyst issues an EPS forecast for the quarter in which the 8-K is filed within two months before the earnings announcement (36% of our full sample). In row (2), we focus on a subsample of filings that no analysts react to (66% of our full sample), where analyst reaction is defined as revising their EPS forecast over the reaction window.[13] In both rows, we observe that our estimates of overpricing resemble those of the main results in Table 3. Therefore, we believe that analyst bias is unlikely to be an important cause of overpricing for non-earnings 8-Ks.

Retail investor participation

Research on retail investors suggests that they are net buyers of securities and typically do not sell short (Barber and Odean 2007; Barber et al. 2009); thus, their participation could cause overpricing simply through buying pressure. Relatedly, Frank and Sanati (2018) also document an asymmetric mispricing pattern but for news articles on S&P 500 firms published by the *Financial Times*. Their explanation is that news articles grab the attention of retail investors. We investigate the role of retail participation in overpricing by interacting *RET_8K* with two alternative proxies for abnormal retail participation. Panel B of Table 7 reports the coefficients of interest.

In row (1), our proxy for retail participation is *RETAIL_TRADE*, abnormal retail trading. Following Boehmer et al. (2021), we identify the volume of retail trades based on NYSE Trade and

13. In our sample, 34% of filings have at least one analyst reacting to them, consistent with the 37.6% observed by Rubin et al. (2017).

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TABLE 7
Alternative mechanisms for overpricing

Panel A: Overpricing and analyst optimism

		Good news			Bad news		
			(1) Coefficient on *RET_8K*	(2)		(3) Coefficient on *RET_8K*	(4)
	Subsamples	Obs.	*Y* = *RET_PRE_EA*	*Y* = *RET_EA*	Obs.	*Y* = *RET_PRE_EA*	*Y* = *RET_EA*
(1)	Stocks without analyst coverage	45,055	−0.028***	−0.004**	45,773	0.017***	0.008***
			(−5.11)	(−2.11)		(2.79)	(4.53)
(2)	Filings without analyst reaction	81,429	−0.026***	−0.003***	82,567	0.018***	0.006***
			(−5.05)	(−2.86)		(3.51)	(4.48)

Panel B: Overpricing and retail participation

		Good news			Bad news		
			(1) Coefficient on *RET_8K*×Proxy	(2)		(3) Coefficient on *RET_8K*×Proxy	(4)
	Proxies for retail participation	Obs.	*Y* = *RET_PRE_EA*	*Y* = *RET_EA*	Obs.	*Y* = *RET_PRE_EA*	*Y* = *RET_EA*
(1)	Retail trading (*RETAIL_TRADE*)	103,107	0.014	−0.017	104,935	−0.016	−0.026
			(0.63)	(−1.17)		(−1.12)	(−0.92)
(2)	Retail attention (*RETAIL_ATTENTION*)	82,931	−0.012	−0.001	83,850	−0.002	−0.001
			(−1.39)	(−0.34)		(−0.17)	(−0.29)

Notes: This table reports the results of testing two alternative mechanisms that may theoretically contribute to overpricing. Panel A reports coefficients from regressing subsequent returns (*RET_PRE_EA* or *RET_EA*) on immediate returns (*RET_8K*) for two subsamples that are less likely to be affected by analysts. Panel B reports the coefficients from regressing subsequent returns (*RET_PRE_EA* or *RET_EA*) on immediate returns (*RET_8K*) interacted with two proxies for retail participation. A filing is classified as conveying good (bad) news if *RET_8K* is positive (negative). The Appendix provides detailed definitions for all variables. All the right-hand-side variables are transformed into scaled decile ranks that range from −0.5 to 0.5 with a mean of zero. The coefficients are the average estimates over 44 quarters from 2005 to 2015 using Fama-MacBeth regressions. Standard errors are adjusted with Newey-West correction for six lags (*t*-statistics are reported in parentheses). ** and *** represent significance levels of 5% and 1%, respectively, using two-tailed *p*-values.

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Quote data and calculate its percentage relative to trades by all investors for each trading day. We then adjust the average retail trading percentage over the immediate window with the average percentage over the benchmark window (from 94 days before to 5 days before the event date). In row (2), our proxy for retail participation is *RETAIL_ATTENTION*, abnormal retail attention based on the Google search volume index (Da et al. 2011; Frank and Sanati 2018). To construct this measure, we first calculate the average index over the immediate window and then adjust it with the average index over the same benchmark window. Since non-earnings 8-Ks are unanticipated and sporadically filed as corporate events occur, they should attract much less retail attention, relative to the news articles published by the *Financial Times* on the highly prominent S&P 500 firms, the subject of study by Frank and Sanati (2018). Consistent with this notion, in our sample, abnormal retail attention as measured by the mean (median) change in the Google search volume index is only 1.9% (0%) more (untabulated) during the immediate window than during the benchmark window. We observe that the overpricing is not associated with *RETAIL_TRADE* or *RETAIL_ATTENTION* in any of the four columns, suggesting that retail participation is unlikely to be a significant cause of the overpricing of non-earnings 8-Ks.

5. Additional analysis

Alternative windows for immediate returns

We test whether our main results in Table 3 are sensitive to the window we choose to calculate immediate returns. Table 8 reports our estimates of overpricing across different alternative windows. In row (1), *RET_EVENT* is returns over three days around the event date (event window). This alternative window serves two purposes. First, we can use it to test the existence of overpricing by informed investors who can trade on tipped information before it becomes public (Callen et al. 2019). Since retail investors largely do not pay attention around the event date (Ben-Rephael et al. 2019), any overpricing in this window is unlikely to be driven by their excessive buying. Second, we can use it to indirectly test whether the observed overpricing is driven by managerial disclosure strategies. Since the disclosures are not visible to investors in this window, any overpricing in this window is unlikely to be driven by managerial disclosure strategies, unless the use of these strategies is correlated with unobservable managerial efforts to influence investor perceptions before the actual disclosures. In row (2), *RET_FILING* is returns over three days around the filing date (filing window). We consider this alternative window to test the degree of overpricing when all investors have observed the disclosure and are actively trading. Next, to address the concern that, when the event and filing date are close to each other, responses around the event date are also influenced by the actual disclosure, in rows (3) and (4) we focus on a subsample of filings whose event window and filing window do not overlap.[14] In all four rows, a filing is classified as conveying good (bad) news if the immediate returns are positive (negative). These estimates of overpricing in all four rows are of similar magnitude to those in Table 3, suggesting that institutional investors also overprice 8-K news in the immediate window and that retail trading or managerial disclosure strategies are unlikely to drive the overpricing by itself.

Overpricing in different subsamples

To test whether the observed overpricing is driven by pricing mistakes inherent to specific types of events, we separately estimate model (1) for each of the four most frequent event types and "Other Items," which agglomerates the rest of the less frequent event types. Table 9 reports their frequency, the mean of the immediate and subsequent returns, and the estimates of overpricing.

14. Our sample size is only 34% of the full sample in rows (3) and (4), because the event and filing date are within four business days for most of the filings, in compliance with the SEC's timeliness requirement. In fact, the two dates are on the same day for 31.74% of the filings in our sample.

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TABLE 8
Asymmetric mispricing of non-earnings 8-K disclosures: Alternative windows for immediate returns

			Good news			Bad news		
				(1) Coefficient on immediate returns	(2)		(3) Coefficient on immediate returns	(4)
		Immediate returns	Obs.	$Y = RET\_PRE\_EA$	$Y = RET\_EA$	Obs.	$Y = RET\_PRE\_EA$	$Y = RET\_EA$
Full sample	(1)	*RET_EVENT*	123,358	−0.017***	−0.003***	125,600	0.016***	0.006***
				(−4.04)	(−2.84)		(3.76)	(6.22)
	(2)	*RET_FILING*	123,110	−0.022***	−0.003**	125,848	0.017***	0.007***
				(−4.93)	(−2.61)		(3.66)	(4.92)
No overlap	(3)	*RET_EVENT*	41,209	−0.018***	−0.005***	43,384	0.011***	0.006***
				(−3.87)	(−2.77)		(3.98)	(3.13)
	(4)	*RET_FILING*	40,833	−0.030***	−0.004*	43,760	0.010**	0.008***
				(−4.76)	(−1.76)		(2.08)	(3.16)

Notes: This table reports the coefficients from regressing subsequent returns (*RET_PRE_EA* or *RET_EA*) on immediate returns calculated in four different ways. In row (1), *RET_EVENT* is returns over the three days around the event date (event window). In row (2), *RET_FILING* is returns over the three days around the filing date (filing window). In rows (3) and (4), the calculation windows for immediate returns are the same as in rows (1) and (2), respectively, but calculated on a subsample of filings for which the event window and filing window do not overlap. In all four rows, a filing is classified as conveying good (bad) news if the immediate returns are positive (negative). The Appendix provides detailed definitions for all variables. All the right-hand-side variables are transformed into scaled decile ranks that range from −0.5 to 0.5 with a mean of zero. The coefficients are the average estimates over 44 quarters from 2005 to 2015 using Fama-MacBeth regressions. Standard errors are adjusted with Newey-West correction for six lags (*t*-statistics are reported in parentheses). *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively, using two-tailed *p*-values.

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TABLE 9
Asymmetric mispricing for each of the most frequent event types

	Good news					
	(1)	(2)	(3)	(4)	(5)	(6)
					Coefficient on *RET_8K*	
	Obs.	*RET_8K* (%)	*RET_PRE_EA* (%)	*RET_EA* (%)	$Y = RET\_PRE\_EA$	$Y = RET\_EA$
Item 1.01: Entry into a Material Definitive Agreement	28,712	5.31	−1.98	−0.63	−0.026***	−0.004
Item 5.02: Departure/Election of Directors or Principal Officers	31,543	4.42	−2.53	−0.55	−0.016***	−0.001
Item 7.01: Regulation FD Disclosure	26,071	4.14	−1.66	−0.46	−0.019***	0.001
Item 8.01: Other Voluntarily Reported Events	38,990	4.55	−2.15	−0.49	−0.025***	−0.004***
Other items that are not one of the four above	13,306	4.38	−1.87	−0.50	−0.014**	−0.008***
	Bad news					
	(1)	(2)	(3)	(4)	(5)	(6)
					Coefficient on *RET_8K*	
	Obs.	*RET_8K* (%)	*RET_PRE_EA* (%)	*RET_EA* (%)	$Y = RET\_PRE\_EA$	$Y = RET\_EA$
Item 1.01: Entry into a Material Definitive Agreement	28,341	−4.85	−2.75	−0.72	0.019***	0.008***
Item 5.02: Departure/Election of Directors or Principal Officers	33,702	−4.61	−2.69	−0.70	0.016**	0.007***
Item 7.01: Regulation FD Disclosure	25,379	−4.17	−2.37	−0.55	0.015**	0.005**
Item 8.01: Other Voluntarily Reported Events	38,687	−4.79	−2.61	−0.59	0.018***	0.006***
Other items that are not one of the four above	14,418	−4.58	−2.37	−0.59	0.018**	0.006**

Notes: This table reports the mispricing patterns estimated separately for each of the most frequent event types. A filing is classified as conveying good (bad) news if *RET_8K* is positive (negative). The Appendix provides detailed definitions for all variables. All the right-hand-side variables are transformed into scaled decile ranks that range from −0.5 to 0.5 with a mean of zero. The coefficients are the average estimates over 44 quarters from 2005 to 2015 using Fama-MacBeth regressions. Standard errors are adjusted with Newey-West correction for six lags (*t*-statistics are reported in parentheses). ** and *** represent significance levels of 5% and 1%, respectively, using two-tailed *p*-values.

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For good news filings, while the degree of overpricing estimated in column (5) (reflected by price correction before the earnings announcement) is similar across event types, the degree of overpricing estimated in column (6) (reflected by price correction during the announcement) varies across event types. Specifically, there is no indication of further price correction during the announcement for Items 1.01, 5.02, and 7.01, suggesting that investors could correct the overreaction faster for these items. For bad news filings, the degree of overpricing is similar across event types in both columns (5) and (6). Overall, since the majority of price correction in Table 3 is concentrated before earnings announcements, these results in Table 9 are generally consistent with the notion that the degree of mispricing is similar across event types.

Moreover, to investigate whether the observed overpricing is driven by managerial discretion with voluntary disclosures, we separately examine voluntary and mandatory filings. Rows (1) and (2) of Table 10 report our estimates of overpricing for these two subsamples. Also, to mitigate the concern that relying on the sign of immediate returns might have misclassified good versus bad news for certain a priori negative events, in row (3) we exclude filings with those events (i.e., Items 1.02, 1.03, 2.04, 2.06, 3.01, 4.01, and 4.02). Lastly, as an indirect test of the possibility that the overpricing is driven by certain ways of news bundling, in row (4) we examine the degree of overpricing for single-item filings that have little room for bundling, since the only way to bundle news in single-item filings is to bundle the same type of events. These estimates in Table 10 are of similar magnitude to those in Table 3, suggesting that the factors discussed above are unlikely to be important causes of our results.

Interactive effects of change in investor disagreement and short-sale constraints

Given the well-documented price underreaction to earnings announcements (Ball and Brown 1968; Foster et al. 1984; Bernard and Thomas 1989) and the likely presence of the two Miller (1977) drivers around those announcements, one could ask why price overreaction to good news is not observed. One potential answer is that increase in disagreement and short-sale constraints interact: the effect of one driver will be stronger when the other driver is sufficiently strong. In other words, these drivers cannot cause *substantial* overpricing without sufficient common presence; while non-earnings 8-Ks have satisfied this condition, as their interpretation difficulty causes a sizable increase in investor disagreement, earnings announcements with greater investor anticipation, more concrete performance numbers, and more subsequent communication with management may be easier to interpret and thus may not induce enough disagreement.

We empirically investigate whether the effects of the two drivers interact by estimating model (1) separately for subsamples with low versus high levels of *DISP_CHANGE* and *CONSTRAIN*, relative to their quarterly median.[15] Table 11 reports our estimates of overpricing for these subsamples. In panel A, where the dependent variable is *RET_PRE_EA*, for good news filings, the high-high subsample experiences the greatest level of overreaction, 3.7%, which is nearly double the average level of 2.0% in column (1) of Table 3. For bad news filings, only the high-high subsample experiences significant underreaction, 3.3%, which is again nearly double the average level of 1.8% in column (3) of Table 3. In panel B, where the dependent variable is *RET_EA*, for good news filings, the two subsamples with high levels of short-sale constraints experience overreaction, while the other two subsamples exhibit underreaction. For bad news filings, only the two subsamples with high levels of increase in disagreement experience significant underreaction.

Overall, results in Table 11 suggest that the largest degree of overpricing occurs when both drivers are strong and thus support our conjecture about the absence of price overreaction to good earnings news. Another nonmutually exclusive possibility is that the increase in

15. To save space, we only tabulate the results with *DISP_CHANGE*, one of our measures for increase in disagreement. We confirm that our results remain qualitatively similar (untabulated) when we use the other four measures in Table 4.

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TABLE 10
Asymmetric mispricing of non-earnings 8-K disclosures: Different subsamples

		Good news			Bad news		
			(1)	(2)		(3)	(4)
			Coefficient on *RET_8K*			Coefficient on *RET_8K*	
	Subsamples	Obs.	*Y* = *RET_PRE_EA*	*Y* = *RET_EA*	Obs.	*Y* = *RET_PRE_EA*	*Y* = *RET_EA*
(1)	Voluntary filings	63,348	−0.021***	−0.002*	62,339	0.018***	0.006***
			(−5.94)	(−1.81)		(3.65)	(5.68)
(2)	Mandatory filings	59,942	−0.018***	−0.003***	63,293	0.016***	0.007***
			(−3.43)	(−2.71)		(3.13)	(4.76)
(3)	Excluding a priori negative events	117,662	−0.019***	−0.002***	119,253	0.018***	0.007***
			(−4.43)	(−3.02)		(3.94)	(5.62)
(4)	Single-item filings	96,142	−0.018***	−0.001*	98,766	0.016***	0.007***
			(−4.96)	(−1.74)		(3.48)	(4.92)

Notes: This table reports the coefficients from regressing subsequent returns (*RET_PRE_EA* or *RET_EA*) on immediate returns (*RET_8K*) for different subsamples of the filings. A filing is classified as conveying good (bad) news if *RET_8K* is positive (negative). Row (1) reports the results for "Voluntary Filings" that contain Item 7.01 or 8.01 or both. Row (2) reports the results for "Mandatory Filings" that do not contain Item 7.01 or 8.01. Row (3) reports the results for our full sample excluding filings with a priori negative events (Items 1.02, 1.03, 2.04, 2.06, 3.01, 4.01, and 4.02). Row (4) reports the results for single-item filings that contain one item with or without Item 9.01. All the right-hand-side variables are transformed into scaled decile ranks that range from −0.5 to 0.5 with a mean of zero. The coefficients are the average estimates over 44 quarters from 2005 to 2015 using Fama-MacBeth regressions. Standard errors are adjusted with Newey-West correction for six lags (*t*-statistics are reported in parentheses). * and *** represent significance levels of 10% and 1%, respectively, using two-tailed *p*-values.

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TABLE 11
Interactive effects of change in disagreement and short-sale constraints

Panel A: Subsequent returns = *RET_PRE_EA*

Good news				Bad news			
		Change in disagreement				Change in disagreement	
		Low	High			Low	High
Short-sale constraints	Low	−0.013**	−0.014***	Short-sale constraints	Low	0.007	0.009
		(−2.42)	(−4.07)			(1.51)	(1.42)
	High	−0.014***	−0.037***		High	0.002	0.033***
		(−4.07)	(−5.18)			(0.24)	(4.96)
High-high versus low-low		−0.024***	*t*-statistics = −4.63	High-high versus Low-low:		0.026**	*t*-statistics = 3.00

Panel B: Subsequent returns = *RET_EA*

Good news				Bad news			
		Change in disagreement				Change in disagreement	
		Low	High			Low	High
Short-sale constraints	Low	0.004***	0.001**	Short-sale constraints	Low	0.002	0.004***
		(2.87)	(2.07)			(1.10)	(4.02)
	High	−0.012*	−0.009***		High	0.006	0.014***
		(−1.96)	(−3.61)			(0.75)	(6.09)
High-high versus Low-low		−0.013***	*t*-statistics = −3.91	High-high versus Low-low		0.012***	*t*-statistics = 3.42

Notes: This table reports the magnitude of overpricing for subsamples with "low" versus "high" levels of change in disagreement (*DISP_CHANGE*) and short-sale constraints (*CONSTRAIN*) relative to their quarterly median. In panels A and B, the magnitude of overpricing is estimated by the coefficient from regressing subsequent returns (*RET_PRE_EA* and *RET_EA*, respectively) on immediate returns (*RET_8K*). A filing is classified as conveying good (bad) news if *RET_8K* is positive (negative). The Appendix provides detailed definitions for all variables. All the right-hand-side variables are transformed into scaled decile ranks that range from −0.5 to 0.5 with a mean of zero. The coefficients are the average estimates over 44 quarters from 2005 to 2015 using Fama-MacBeth regressions. Standard errors are adjusted with Newey-West correction for six lags (*t*-statistics are reported in parentheses). *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively, using two-tailed *p*-values.

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TABLE 12
Reasons for price correction before earnings announcements

Information availability			Informed trading		
	Good news (1) *RET_PRE_EA*	Bad news (2) *RET_PRE_EA*		Good news (3) *RET_PRE_EA*	Bad news (4) *RET_PRE_EA*
RET_8K	−0.023***	0.013***	*RET_8K*	−0.029***	0.007*
	(−3.35)	(4.23)		(−7.09)	(1.76)
RET_8K×INFORMATION	−0.025*	0.057***	*RET_8K×INFORMED_TRADE*	−0.078***	0.073***
	(−1.92)	(4.17)		(−6.78)	(6.64)
INFORMATION	−0.044***	−0.056***	*INFORMED_TRADE*	−0.126***	−0.135***
	(−4.50)	(−5.13)		(−12.78)	(−12.75)
Controls	Yes	Yes	Controls	Yes	Yes
Item FE	Yes	Yes	Item FE	Yes	Yes
Industry FE	Yes	Yes	Industry FE	Yes	Yes
Observations	73,520	75,493	Observations	123,326	125,632
R^2	8.33%	8.44%	R^2	10.02%	10.24%

Notes: This table reports the estimates from regressing returns before earnings announcement (*RET_PRE_EA*) on immediate returns (*RET_8K*) interacted with the quantity of other public information (*INFORMATION*) in columns (1) to (2) and with the scale of informed trading (*INFORMED_TRADE*) in columns (3) to (4). A filing is classified as conveying good (bad) news if *RET_8K* is positive (negative). The control variables are the same as those in Table 3. The Appendix provides detailed definitions for all variables. All the right-hand-side variables are transformed into scaled decile ranks that range from −0.5 to 0.5 with a mean of zero. The coefficients are the average estimates over 44 quarters from 2005 to 2015 using Fama-MacBeth regressions. Standard errors are adjusted with Newey-West correction for six lags (*t*-statistics are reported in parentheses). * and *** represent significance levels of 10% and 1%, respectively, using two-tailed *p*-values.

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disagreement is indeed sufficiently high for earnings announcements but other drivers of symmetric underreaction, such as investors' failure to consider the implications of current earnings for future earnings (Bernard and Thomas 1990), are stronger than the Miller (1977) mechanism and thus dominate.

The concentration of price correction before earnings announcements

Our main results in Tables 3 suggest that the majority of price correction occurs *before* investors see the impact of 8-K events through earnings announcements. In this section, we explore the reasons for this concentration. Since Ball and Brown (1968), the literature has consistently shown that information released before earnings announcements can drive price in the correct direction (Beyer et al. 2010; Drake et al. 2012). In our sample, there are 51 trading days on average between the 8-K filing date and the subsequent earnings announcement. Therefore, we conjecture that investors are likely to obtain other public information or privately produce more information during this period, which enables them to substantially correct the price in advance of the formal earnings announcement. We empirically test this conjecture by regressing returns before the earnings announcement (*RET_PRE_EA*) on immediate returns (*RET_8K*) interacted with proxies for the quantity of other public information or the degree of informed trading during the Pre-EA window. Table 12 reports the results.

In columns (1) and (2), we use *INFORMATION*, the abnormal number of RavenPack articles during the Pre-EA window, as a proxy for the quantity of other public information. To ensure the informativeness of the articles, we require the firm name to be mentioned in the main title or headline of the news article (i.e., RavenPack variable RELEVANCE is above 90) and the news itself to be nontrivial (i.e., RavenPack variable NIP is above 50).[16] We find that the interaction coefficient is significantly negative in column (1) and positive in column (2), consistent with the notion that a larger quantity of other public information facilitates price correction during this period. In columns (3) and (4), we use *INFORMED_TRADE*, the abnormal bid-ask spread during the Pre-EA window, as a proxy for the degree of private information production, as prior studies suggest a correlation between the degree of private information production and the degree of informed trading reflected by abnormal bid-ask spread (Jayaraman 2008). We find that the interaction coefficient is significantly negative in column (3) and positive in column (4), consistent with the notion that more private information production also helps with price correction, even before the earnings announcement. In an untabulated analysis, we alternatively use abnormal illiquidity (Amihud 2002) as a proxy for informed trading and find qualitatively similar results.

6. Conclusion

We propose and find evidence for an asymmetric mispricing of the information in non-earnings 8-Ks: stock prices overreact to good news but underreact to bad, resulting in overpricing for both. This overpricing is not driven by specific types of events, a particular concentration of event types across good and bad news, or differences across voluntary and mandatory filings.

We find that this overpricing most consistently intensifies with an increase in investor disagreement and short-sale constraints, as modeled by Miller (1977). The effects of these drivers are interactive: overpricing is more likely to occur when both drivers are sufficiently strong. We fail to find enough evidence in support of other potential mechanisms, including managerial disclosure strategies, the influence of analyst optimism, or abnormal retail investor participation.

16. As suggested by RavenPack User Guide 4.0, RELEVANCE measures how strongly an entity is related to the underlying news story. A value higher than 90 means that the entity is referenced in the title or headline of the news item. NIP measures the impact of a news article based on the volatility of the stock price over the two hours following its release, and NIP works the best when RELEVANCE is above 90. NIP is centered at 50, which represents zero impact, with values above 50 indicating nontrivial impact.

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We observe that the correction of overpricing happens before and during the forthcoming earnings announcement, with a concentration before the announcement. The degree of correction increases with the quantity of other public information and the scale of private information production before the announcement, suggesting that, as investors subsequently obtain more information, they can substantially correct the price, even before seeing the impact of 8-K events on earnings.

Appendix: Variable definitions

Variable	Definition
Immediate and subsequent returns	
RET_8K	Four-factor-adjusted returns (Carhart 1997) from one trading day before the event date to one trading day after the filing date (immediate window)
RET_EVENT	Four-factor-adjusted returns (Carhart 1997) over three trading days around the event date (event window)
RET_FILING	Four-factor-adjusted returns (Carhart 1997) over three trading days around the filing date (filing window)
RET_PRE_EA	Four-factor-adjusted returns (Carhart 1997) from two trading days after the filing date to two trading days before the forthcoming earnings announcement (Pre-EA window)
RET_EA	Four-factor-adjusted returns (Carhart 1997) over three trading days around the forthcoming earnings announcement (EA window)
Proxies for change in disagreement and short-sale constraints	
DISP_CHANGE	The change in the dispersion of the forecasts for the current fiscal year by skilled analysts from just before the event date to just after the filing date scaled by the stock price (Compustat PRCCQ) at the end of the last quarter. The skilled analysts are those with a higher-than-median cumulative reaction ratio (CRR), following Rubin et al. (2017). CRR is an analyst-firm-quarter specific measure constructed as the percentage of non-earnings 8-Ks filed by the firm up to the end of the last fiscal quarter to which the analyst reacted by revising her forecast within a window between the event date and three days after the filing date (reaction window)
NO_REACT	The percentage of analysts who do not revise their EPS forecasts within a window between the event date and three days after the filing date (reaction window)
AB_TURN	Abnormal turnover from one trading day before the event date to one trading day after the filing date (immediate window), calculated as the average daily turnover over this window minus the average daily turnover over a 90-day benchmark window from 94 days before to 5 days before the event date
IDO_VOL	Idiosyncratic return volatility from one trading day before the event date to one trading day after the filing date (immediate window), calculated as the standard deviation of the daily return residual from the four-factor model
OPTIMISM	Investor optimism as reflected by the average daily PVGO index from one trading day before the event date to one trading day after the filing date (immediate window). Following Chang et al. (2020), the PVGO index is calculated as $(P-(EPS/R))/P$, where P is the stock price (CRSP PRC) at the end of each trading day in the immediate window, *EPS* is the diluted earnings per share from the last fiscal quarter (Compustat EPSFXQ), and R is the firm's industry cost of capital, measured as the sum of the risk-free rate and the Fama-French 48-industry risk premium. If *EPS* is negative, PVGO is set as one. If EPS/R is greater than P, PVGO is set as zero
CONSTRAIN	Average daily cost of borrowing score (DCBS provided by Markit) from one trading day before the event date to one trading day after the filing date (immediate window)

(The table is continued on the next page.)

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(continued)

Variable	Definition
Proxies for managerial disclosure strategies	
TONE	The percentage of positive words minus the percentage of negative words in the 8-K. The list for positive and negative words is obtained from https://sraf.nd.edu/textual-analysis/resources/
BUNDLING	For good news filings (*RET_FILING* > 0), *BUNDLING* is an indicator variable that equals one if an aggregate mandatory positive item is filed with an aggregate voluntary positive item, and zero otherwise. For bad news filings (*RET_FILING* ≤ 0), *BUNDLING* equals one if an aggregate mandatory negative item is filed with an aggregate voluntary positive item, and zero otherwise. For each 8-K, we first aggregate all of the voluntary items (Item 7.01 or 8.01) and all of the mandatory items (other items excluding Item 9.01) and then classify whether the aggregated voluntary or mandatory item is positive or negative based on its aggregated *TONE*. Specifically, if an aggregated item's tone is in the top (bottom) quarterly tercile, we regard it as a positive (negative) item
TIMING	An indicator variable that equals one if the 8-K is filed after trading hours or on the last trading day of a week, and zero otherwise
FOG	The Fog index for each 8-K following Li (2008)
UNCERTAINTY	The percentage of words that indicate uncertainty in the 8-K based on the word list from https://sraf.nd.edu/textual-analysis/resources/
Proxies for retail participation	
RETAIL_TRADE	Logarithm of the average percentage of retail trades from one trading day before the event date to one trading day after the filing date (immediate window) minus the logarithm of the average percentage of retail trades over a 90-day benchmark window from 94 days before to 5 days before the event date, where the percentage of retail trade is calculated as retail volume divided by total volume. We follow Boehmer et al. (2021) in identifying retail trades
RETAIL_ATTENTION	Logarithm of the average daily Google search volume (GSV) index from one trading day before event date to one trading day after the filing date (immediate window) minus the logarithm of the average index over a 90-day benchmark window from 94 days before to 5 days before the event date
Proxies for investor information before earnings announcements	
INFORMATION	Average number of RavenPack articles from two trading days after the filing date to two trading days before the forthcoming earnings announcement (Pre-EA window) minus the average number of articles over a 90-day benchmark window from 94 days before to 5 days before the event date. We require RavenPack articles to have sufficient relevance and impact (i.e., variable RELEVANCE > 90 and NIP > 50). Refer to footnote 16 for more information on these two variables
INFORMED_TRADE	Average bid-ask spread from two trading days after the filing date to two trading days before the forthcoming earnings announcement (Pre-EA window) minus the average spread over a 90-day benchmark window from 94 days before to 5 days before the event date. Using CRSP variables, daily bid-ask spread is calculated as (ASK − BID)/((ASK + BID)/2)
Firm-quarter-level control variables	
SIZE	Logarithm of market capitalization (Compustat PRCCQ×CSHOQ) at the end of the last quarter
BTM	Logarithm of 1 plus book value of equity (COMPUSTAT CEQQ) divided by market capitalization (Compustat PRCCQ×CSHOQ) at the end of the last quarter
MOM	Four-factor-adjusted returns (Carhart 1997) over six months ending at the end of the last quarter

(The table is continued on the next page.)

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(continued)

Variable	Definition
EARN_CHANGE	Seasonal change in earnings from the last quarter, calculated as change in earnings per share (Compustat IBQ/CSHPRQ) scaled by the stock price (Compustat PRCCQ) at the end of the quarter
ACCRUAL	Accounting accruals from the last quarter, following Collins and Hribar (2000). Using Compustat variables, ACCRUAL = (IBCY − (OANCFY − XIDOCY))/((ATQ + Lagged ATQ)/2)

References

Amihud, Y. 2002. Illiquidity and stock returns: Cross-section and time-series effects. *Journal of Financial Markets* 5 (1): 31–56.

Ball, R., and P. Brown. 1968. An empirical evaluation of accounting income numbers. *Journal of Accounting Research* 6 (2): 159–78.

Bamber, L. S., O. E. Barron, and T. L. Stober. 1997. Trading volume and different aspects of disagreement coincident with earnings announcements. *The Accounting Review* 72 (4): 575–97.

Barber, B. M., and T. Odean. 2007. All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies* 21 (2): 785–818.

Barber, B. M., T. Odean, and N. Zhu. 2009. Systematic noise. *Journal of Financial Markets* 12 (4): 547–69.

Bar-Hava, K., S. Huang, B. Segal, and D. Segal. 2018. Do independent directors tell the truth, the whole truth, and nothing but the truth when they resign? *Journal of Accounting, Auditing and Finance* 36 (1): 3–29.

Beneish, M. D., C. M. C. Lee, and D. C. Nichols. 2015. In short supply: Short-sellers and stock returns. *Journal of Accounting and Economics* 60 (2): 33–57.

Ben-Rephael, A., Z. Da, P. D. Easton, and R. D. Israelsen. 2019. Does SEC Form 8-K provide information necessary or useful for the protection of investors? Working paper, https://sites.google.com/site/abenreph/home/research

Berkman, H., V. Dimitrov, P. C. Jain, P. D. Koch, and S. Tice. 2009. Sell on the news: Differences of opinion, short-sales constraints, and returns around earnings announcements. *Journal of Financial Economics* 92 (3): 376–99.

Bernard, V. L., and J. K. Thomas. 1989. Post-earnings-announcement drift: Delayed price response or risk premium? *Journal of Accounting Research* 27: 1–36.

Bernard, V. L., and J. K. Thomas. 1990. Evidence that stock prices do not fully reflect the implications of current earnings for future earnings. *Journal of Accounting and Economics* 13 (4): 305–40.

Beyer, A., D. A. Cohen, T. Z. Lys, and B. R. Walther. 2010. The financial reporting environment: Review of the recent literature. *Journal of Accounting and Economics* 50 (2): 296–343.

Bird, A., S. A. Karolyi, and P. Ma. 2018. Strategic disclosure misclassification. Working paper, https://ssrn.com/abstract=2778805

Bloomfield, R. J. 2002. The "incomplete revelation hypothesis" and financial reporting. *Accounting Horizons* 16 (3): 233–43.

Boehme, R. D., B. R. Danielsen, and S. M. Sorescu. 2006. Short-sale constraints, differences of opinion, and overvaluation. *Journal of Financial and Quantitative Analysis* 41 (2): 455–87.

Boehmer, E., C. M. Jones, X. Zhang, and X. Zhang. 2021. Tracking retail investor activity. *Journal of Finance* 76 (5): 2249–305.

Callen, J. L., R. Kaniel, and D. Segal. 2019. Filing speed, information leakage, and price formation. Working paper, https://ssrn.com/abstract=3363056

Callen, J. L., J. Livnat, and D. Segal. 2006. Accounting restatements: Are they always bad news for investors? *Journal of Investing* 15 (3): 57–68.

19113846, 2022, 2, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/1911-3846.12756 by City University Of Hong Kong, Wiley Online Library on [14/05/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Carhart, M. M. 1997. On persistence in mutual fund performance. *Journal of Finance* 52 (1): 57–82.

Chang, Y., P. Hsiao, A. Ljungqvist, and K. Tseng. 2020. Testing disagreement models. Working paper, https://ssrn.com/abstract=3489666

Collins, D. W., and P. Hribar. 2000. Earnings-based and accrual-based market anomalies: One effect or two? *Journal of Accounting and Economics* 29 (1): 101–23.

Cookson, J. A., and M. Niessner. 2020. Why don't we agree? Evidence from a social network of investors. *Journal of Finance* 75 (1): 173–228.

Da, Z., J. Engelberg, and P. Gao. 2011. In search of attention. *Journal of Finance* 66 (5): 1461–99.

Davis, A. K., J. M. Piger, and L. M. Sedor. 2012. Beyond the numbers: Measuring the information content of earnings press release language. *Contemporary Accounting Research* 29 (3): 845–68.

DeBondt, W. F. M., and R. Thaler. 1985. Does the stock market overreact? *Journal of Finance* 40 (3): 793–805.

Desai, H., K. Ramesh, S. R. Thiagarajan, and B. V. Balachandran. 2002. An investigation of the informational role of short interest in the Nasdaq market. *Journal of Finance* 57 (5): 2263–87.

Diether, K. B., C. J. Malloy, and A. Scherbina. 2002. Differences of opinion and the cross section of stock returns. *Journal of Finance* 57 (5): 2113–41.

Drake, M. S., D. T. Roulstone, and J. R. Thornock. 2012. Investor information demand: Evidence from Google searches around earnings announcements. *Journal of Accounting Research* 50 (4): 1001–40.

Feldman, R., S. Govindaraj, J. Livnat, and B. Segal. 2010. Management tone change, post earnings announcement drift and accruals. *Review of Accounting Studies* 15 (4): 915–53.

Feldman, R., J. Livnat, and B. Segal. 2008. Shorting companies that restate previously issued financial statements. *Journal of Investing* 17 (3): 6–15.

Figlewski, S. 1981. The informational effects of restrictions on short sales: Some empirical evidence. *Journal of Financial and Quantitative Analysis* 16 (4): 463–76.

Foster, G., C. Olsen, and T. Shevlin. 1984. Earnings releases, anomalies, and the behavior of security returns. *The Accounting Review* 59 (4): 574–603.

Frank, M. Z., and A. Sanati. 2018. How does the stock market absorb shocks? *Journal of Financial Economics* 129 (1): 136–53.

Gleason, C. A., and C. M. Lee. 2003. Analyst forecast revisions and market price discovery. *The Accounting Review* 78 (1): 193–225.

Harbaugh, R., J. Maxwell, and K. Shue. 2016. Consistent good news and inconsistent bad news. Working paper, https://sites.google.com/site/kellyshue/

He, S., and G. G. Narayanamoorthy. 2020. Earnings acceleration and stock returns. *Journal of Accounting and Economics* 69 (1): 101238.

Hirshleifer, D., and S. H. Teoh. 2003. Limited attention, information disclosure, and financial reporting. *Journal of Accounting and Economics* 36 (1): 337–86.

Hong, H., and J. D. Kubik. 2003. Analyzing the analysts: Career concerns and biased earnings forecasts. *Journal of Finance* 58 (1): 313–51.

Huang, X., S. H. Teoh, and Y. Zhang. 2014. Tone management. *The Accounting Review* 89 (3): 1083–113.

Jayaraman, S. 2008. Earnings volatility, cash flow volatility, and informed trading. *Journal of Accounting Research* 46 (4): 809–51.

Kandel, E., and N. D. Pearson. 1995. Differential interpretation of public signals and trade in speculative markets. *Journal of Political Economy* 103 (4): 831–72.

Kim, O., and R. E. Verrecchia. 1994. Market liquidity and volume around earnings announcements. *Journal of Accounting and Economics* 17 (1): 41–67.

Kondor, P. 2012. The more we know about the fundamental, the less we agree on the price. *Review of Economic Studies* 79 (3): 1175–207.

Lakonishok, J., A. Shleifer, and R. W. Vishny. 1994. Contrarian investment, extrapolation, and risk. *Journal of Finance* 49 (5): 1541–78.

Lerman, A., and J. Livnat. 2010. The new Form 8-K disclosures. *Review of Accounting Studies* 15 (4): 752–78.

19113846, 2022, 2, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/1911-3846.12756 by City University Of Hong Kong, Wiley Online Library on [14/05/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Li, F. 2008. Annual report readability, current earnings, and earnings persistence. *Journal of Accounting and Economics* 45 (2): 221–47.

Lin, H., and M. F. McNichols. 1998. Underwriting relationships, analysts' earnings forecasts and investment recommendations. *Journal of Accounting and Economics* 25 (1): 101–27.

Livnat, J., and R. R. Mendenhall. 2006. Comparing the post-earnings announcement drift for surprises calculated from analyst and time series forecasts. *Journal of Accounting Research* 44 (1): 177–205.

Loughran, T., and B. McDonald. 2010. Measuring readability in financial text. Working paper, http://securitieseditor.com/wp/wp-content/uploads/2014/05/Plain_English_v5.pdf

Loughran, T., and B. McDonald. 2011. When is a liability not a liability? Textual analysis, dictionaries, and 10-Ks. *Journal of Finance* 66 (1): 35–65.

Ma, G. 2019. The information content of operations-related disclosures. *Journal of Accounting Literature* 43: 87–107.

McMullin, J. L., B. P. Miller, and B. J. Twedt. 2019. Increased mandated disclosure frequency and price formation: Evidence from the 8-K expansion regulation. *Review of Accounting Studies* 24 (1): 1–33.

Miao, B., S. H. Teoh, and Z. Zhu. 2016. Limited attention, statement of cash flow disclosure, and the valuation of accruals. *Review of Accounting Studies* 21 (2): 473–515.

Miller, E. M. 1977. Risk, uncertainty, and divergence of opinion. *Journal of Finance* 32 (4): 1151–68.

Nagel, S. 2005. Short sales, institutional investors and the cross-section of stock returns. *Journal of Financial Economics* 78 (2): 277–309.

Niessner, M. 2015. Strategic disclosure timing and insider trading. Working paper, https://ssrn.com/abstract=2439040

Noh, S., E. C. So, and J. P. Weber. 2019. Voluntary and mandatory disclosures: Do managers view them as substitutes? *Journal of Accounting and Economics* 68 (1): 101243.

O'Brien, P. C., M. F. McNichols, and L. Hsiou-Wei. 2005. Analyst impartiality and investment banking relationships. *Journal of Accounting Research* 43 (4): 623–50.

Rennekamp, K. 2012. Processing fluency and investors' reactions to disclosure readability. *Journal of Accounting Research* 50 (5): 1319–54.

Rubin, A., B. Segal, and D. Segal. 2017. The interpretation of unanticipated news arrival and analysts' skill. *Journal of Financial and Quantitative Analysis* 52 (4): 1491–518.

SEC. 1989. Financial reporting release nos. 33-6822, 34-26587: Accelerations of the timing for filing Form 8-K related to changes in accountants and resignations of directors.

SEC. 2004. Financial reporting release nos. 33-8400, 34-49424: Final rule: Additional Form 8-K disclosure requirements and acceleration of filing date.

Segal, B., and D. Segal. 2016. Are managers strategic in reporting non-earnings news? Evidence on timing and news bundling. *Review of Accounting Studies* 21 (4): 1203–44.

Sloan, R. 1996. Do stock prices fully reflect information in accruals and cash flows about future earnings? *The Accounting Review* 71 (3): 289–315.

Thomas, J., and F. Zhang. 2008. Overreaction to intra-industry information transfers? *Journal of Accounting Research* 46 (4): 909–40.

You, H., and X. Zhang. 2009. Financial reporting complexity and investor underreaction to 10-K information. *Review of Accounting Studies* 14 (4): 559–86.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix O1: Frequency and average immediate returns for each event type (good and bad news combined)

Appendix O2: Overpricing and management disclosure strategies (full analysis)

Appendix O3: Alternative specifications

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