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Unexpected distractions and investor attention to corporate announcements

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Abstract
We investigate how unexpected distractions affect investor reactions to corporate earnings announcements. We use a daily news pressure (DNP) index as a proxy for the presence of potential investor distraction. Since breaking news captured by this index is largely unpredictable and unrelated to investors' valuation decisions, our research design offers a unique opportunity to examine investor attention in the absence of strategic timing of announcements by managers. Using overall trading volume and Google searches as measures of investor attention, we find that investors are susceptible to distractions in their reactions to earnings announcements. We further find that DNP measures a form of distraction that affects retail but not institutional investors. Furthermore, in contrast to prior research that employs predictable measures of distraction, we find that price reactions to earnings announcements are not affected by unexpected distractions. Our results reveal that unexpected distractions reduce the attention of retail investors to earning announcements but do not necessarily lead to observable pricing effects.

Keywords Investor attention · Earnings announcements · Retail trading · Distraction

JEL Classification G12 · G14 · L20 · M41

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1 Introduction

This study investigates how unexpected distractions affect investor attention to corporate announcements. A growing literature in behavioral economics suggests that attention is a scarce cognitive resource (Kahneman 1973), and prior analytical research offers several frameworks in which limited investor attention is expected to affect capital market activity. Yet recent empirical studies provide somewhat conflicting evidence on the existence and capital market consequences of investor inattention to corporate announcements. One possible reason for this ambiguity is the use of pre-scheduled or otherwise anticipatable measures of high-distraction periods, creating the possibility that managers strategically time their announcements and release systematically different types of information during high-distraction periods. This creates an empirical challenge for distinguishing investor distraction from a potentially attentive investor response to these different strategic disclosures. In this paper, we use a plausibly exogenous measure of unexpected distraction, and this identification strategy allows us to examine how distraction affects investor attention to earnings announcements in a setting where strategic disclosure timing is unlikely to be a concern.

To develop a proxy for potential distraction that is unpredictable by either investors or managers, we adopt the approach outlined by Eisensee and Stromberg (2007) and construct a time-series of the Daily News Pressure (DNP) index. DNP is defined as the median number of minutes across the three main U.S. television news broadcasts devoted to the first three news segments. It measures the availability of newsworthy material on a given day. There are two key benefits of using DNP as a measure of potential distraction. First, DNP is a daily measure; unlike prior measures, which are limited to either weekly or seasonal events, DNP enables us to examine the effect of distraction on investor attention at a daily frequency. Second, and more importantly, because breaking news is largely unpredictable, the use of DNP helps mitigate the concern of self-selection related to strategic disclosure timing based on the perceived level of investor attention. Occasionally high news pressure may be predictable, but the vast majority of distractions represented by DNP are not known in advance and are plausibly exogenous to the content of earnings announcements and macroeconomic news. We hypothesize that investor attention to earnings announcements is weaker on days with high levels of unexpected distractions as measured by DNP.

We test this hypothesis using a set of 139,874 quarterly earnings announcements made by 3,405 unique firms, from January 1, 1995, to December 31, 2015, although, for some tests, data are available only for more recent years. We estimate investor attention using overall trading volume and Google searches as general measures of investor attention. In using measures of trading volume to estimate investor attention, we follow a substantial body of research that treats overall trading volume as a fundamental, nondirectional measure of investor activity (Beaver 1968; Verrecchia 2001; Bamber et al. 2011). We assume that investors are more likely to trade a particular stock in response to an earnings announcement when they pay more attention to it.

Therefore, consistent with prior research, we presume trading volume is a monotonically increasing function of investor attention (Barber and Odean 2008; Gervais et al. 2001; Israeli et al. 2021). However, the rise of algorithmic trading raises the possibility that some proportion of trades is programmed, making trading volume a weak proxy for investor attention. Moreover, measures of trading volume do not reflect instances of investor attention in which investors pay attention to a particular earnings announcement but ultimately decide not to trade. To address these concerns, we consider abnormal Google searches as a complementary measure of investor attention. Search activity is potentially more sensitive to investor distraction, as it allows us to capture dimensions of investor attention that trading volume cannot.

Our findings reveal that trading volume responses to earnings announcements are significantly muted when those announcements occur on days with high unexpected distractions. We find that a one standard deviation increase in the level of distraction on a firm's earnings announcement day is associated with a 1.16 percentage point reduction in overall trading volume. Given that our measure of overall trading volume is 37.2% higher around earnings announcements, relative to the non-announcement periods, this effect implies a 3.12% reduction in overall investor attention to earnings announcements on high distraction days. We also find that Google searches around earnings announcements that occur on high-distraction days are significantly lower than those occurring on low-distraction days.

We further hypothesize that unexpected distractions as measured by DNP are likely to affect the attention of retail but not institutional investors. We use abnormal retail trading volume and Bloomberg searches as specific measures of retail and institutional investor attention, respectively (Ben-Rephael et al. 2017; Boehmer et al. 2021). Consistent with our hypothesis that the reduced investor attention is concentrated among retail investors, we find that a one standard deviation increase in the level of distraction on a firm's earnings announcement day is associated with a 3.75 percentage point reduction in retail trading volume. Our measure of retail trading volume is 52.7% higher around earnings announcements, relative to the non-announcement periods, indicating that retail investors allocate more attention to earnings announcements than they do at other times. However, when those announcements occur on high distraction days, there is a 7.12% reduction in retail investor attention.

In contrast, we find no evidence of distraction among institutional investors. The level of Bloomberg search activity around earnings announcements does not vary with level of DNP, suggesting institutional investors' search activities are not sensitive to unexpected distractions. Overall, our results offer strong evidence in support of the hypothesis that overall attention to earnings announcements is lower on days with high unexpected distractions and that these effects are concentrated primarily among retail investors. Institutional investor attention, in contrast, appears unaffected by unexpected distractions as measured by DNP.

Having established that unexpected distractions lower retail but not institutional investor attention, we further examine whether this inattention affects equilibrium

market prices. The relative roles of retail and institutional traders in price discovery is an unresolved question. On one hand, the noisy rational expectations literature predicts that price efficiency depends critically upon the presence of retail traders (Admati 1985; Diamond and Verrecchia 1981; Grossman and Stiglitz 1980; Hellwig 1980; Kyle 1985; 1989; Verrecchia 1982). By providing liquidity, retail investors allow informed traders to efficiently incorporate their private information into prices. At the same time, Ben-Rephael et al. (2017) report that institutional investor attention primarily drives observed price reactions to earnings news, suggesting that the liquidity provided by retail traders may not be essential to price discovery around earnings announcements. We examine how reduced retail investor attention, arising from unexpected distractions, affects price efficiency using three measures: abnormal cumulative stock returns over days [0, 1] and [2, 60] and timeliness of earnings information over days [0, 5] relative to a firm's earnings announcement. We employ the Butler et al. (2007) intraperiod-earnings-timeliness metric to capture how quickly earnings information is impounded into price. Research suggests that reduced investor attention should lead to slower price discovery around earnings announcements, as evidenced by weaker immediate price reactions and stronger post-announcement drifts in share prices. However, these inferences are based on studies that use highly predictable and thus potentially endogenous measures of distraction and that do not consider the differential attentiveness of retail and institutional investors. Our results reveal no significant associations between the level of unexpected distractions and any of our three measures of price efficiency. The lack of significant association between DNP and each of the three measures is not sensitive to the amount of new information that arrives in the market on a firm's earnings announcement or to the empirical model we use to test for the relation. Overall, these findings suggest that price efficiency can persist, despite retail investor inattention.

Our study contributes to the literature on investor attention along three central dimensions. (1) We provide evidence of the pervasive nature of strategic disclosure timing, which in turn necessitates measures of unexpected distraction, such as DNP, to draw valid inferences about investor attention to corporate announcements. (2) We provide evidence that retail investors but not institutional investors are susceptible to such unexpected distractions. (3) We show that limited attention from retail investors arising from unexpected distractions does not lead to delayed price responses to earnings announcements.

First, we use DNP to measure the existence of competing stimuli to examine whether the arrival of mostly unexpected and value-irrelevant distractions affect investor attention to earnings announcements.[1] The literature proposes a variety of measures of potential investor distraction: the incidence of announcements on Fridays (DellaVigna and Pollet 2009); major sporting events such as the Olympics, World Series, or March Madness (Drake et al. 2016); scheduled releases of key

[1]DNP as a measure of investor distraction was initially used in an earlier version of this study titled "The Timing of Management Earnings Forecasts and Investor Inattention." That draft was circulated as early as 2010 and is available from the authors upon request.

macroeconomic indicators (Kasznik and Kremer 2014); and days with many earnings announcements (Hirshleifer et al. 2009).[2] In each of these settings, purported distraction is pre-scheduled and known to market participants long before the release of firm-specific information. Hence it is likely that managers anticipate the potential distraction and strategically disclose certain types of information. For instance, Koester et al. (2016) illustrate that managers strategically disclose positive earnings surprise to engender investor attention when they believe the stock is neglected.

It is critical to use a measure of potential investor distraction that is not subject to strategic timing concerns, because the strategic timing of firm announcements could lead to spurious inferences about the effect of distraction on investor attention, due to selection bias. When managers engage in strategic disclosure timing, observed investor reaction will be a response not only to the potential competing stimuli but also to the fundamentally different nature of information being released. This makes it difficult to disentangle whether the observation of reduced attention is due to a distraction or to differences in the disclosures themselves. Therefore, the existence of strategic disclosure timing necessitates a measure of competing stimuli that is unanticipated and does not provide value-relevant information. The measure of competing stimuli that we use in this study, DNP, is superior to the ones used in the literature, as it is more plausibly unpredictable and exogenous to investor valuation decisions.

We take several steps to ensure that DNP indeed reflects unpredictable distractions. We first show that its distribution is not seasonal within weeks or across months or years. Next, we assess the existence of strategic disclosure timing by examining whether the content of earnings announcements varies with the degree of competing stimuli. In the absence of strategic disclosure timing, we should not observe a difference in the content of announcements across high and low distraction periods. If managers do consider potential investor distraction in determining when to disclose earnings, this should manifest in a systematic difference in the content of earnings during high and low distraction periods. Consistent with managers not strategically timing their earnings disclosures according to DNP levels, we find that the frequency of losses reported on days with high DNP is statistically indistinguishable from the frequency of losses reported on days with low DNP. In contrast, when we examine other measures of investor distraction examined in the prior literature, we find that the likelihood that managers report losses is significantly higher on Fridays, NCAA tournament days, and days with fewer concurrent earnings announcements.

These findings suggest managers do not strategically time their disclosures around the level of DNP but that they do potentially strategically time disclosures around predictable events, such as Fridays, earnings announcements of other companies, and sporting events. These features of DNP allow us to more credibly examine how

[2] A tangential literature, including the work of Bushee and Friedman (2016) and deHaan et al. (2017), explores the impact of weather on investor behavior. Although seemingly related to our study, these papers differ critically in focus. In these studies, weather is not used as a measure of distraction but rather as a shock to individuals' moods. In contrast, our goal is to understand the impact of distractions, independent of mood or sentiment, on investor attention. While DNP may exhibit a low degree of correlation with mood, an important feature of the measure is that it is not systematically related to investor mood. We offer more detail on this point in Section 3.1

investor attention to earnings announcements is sensitive to distractions. Our findings provide compelling evidence of a reduced investor attention on high DNP days, even after controlling for other measures of competing stimuli. Moreover, we find that DNP is the only measure that has a consistently negative association with investor attention.

A second contribution of our study is our separate consideration of retail and institutional investors. We find that not all investors are equally susceptible to distractions, especially given the salience of earnings news to the market. Earnings announcements are typically scheduled, and research shows that their scheduling has information content (deHaan et al. 2015; Johnson and So 2018). This feature of earnings announcements allows sophisticated investors to anticipate the release of corporate information and adjust their attention. The same might not be true for retail investors, which would cause the level of attention to such announcements to differ across theses investor groups. By distinguishing between two types of investors, we can provide finer evidence on the effect of unexpected distractions on investor attention.

A third contribution of our study is our finding that unexpected distractions do not result in less efficient pricing of earnings announcement information. This finding challenges the literature, which concludes that investor inattention is associated with a reduction in price efficiency (DellaVigna and Pollet 2009; Hirshleifer et al. 2009; Drake et al. 2016). We show that unexpected distractions lower retail but not institutional investor attention. At the same time, we observe that both the magnitude and speed of price response around earning announcements are unaffected by the reduced retail investor attention that results from unexpected distractions. Hence our study offers evidence that consideration of the types of investors who might be sensitive to such distractions is critical to a complete understanding of the relation between investor attention and equilibrium market pricing.

Our findings complement theoretical models of noisy rational expectations. Such models predict that an absence of retail traders, because of distracting or other events, should result in less efficient pricing (Admati 1985; Diamond and Verrecchia 1981; Grossman and Stiglitz 1980; Hellwig 1980; Kyle 1985; 1989; Verrecchia 1982), and empirical evidence supports this prediction (Israeli et al. 2017). However, the noisy rational expectations literature does not specify the exact amount of retail trading needed to facilitate informed trading and suggests that price efficiency should be an increasing function of retail trading. Therefore, another contribution of our paper is to illustrate that there is a degree of retail investor distraction that can exist without disturbing price discovery. We believe this nuanced observation marks an important contribution to the understanding of the relation between distraction and price discovery.

Most closely related to our study is contemporaneous work by Peress and Schmidt (2020), who investigate the causal effect of retail trading on stock market liquidity. Focusing on a limited sample of extreme news pressure days, they show that, on average, liquidity decreases on days with high news pressure and that this decline in liquidity is likely the result of retail investors not trading as frequently on high news pressure days. Importantly, their objective differs fundamentally from ours. We study the consequences of distractions to investor reaction to disclosure in the absence of

strategic disclosure timing. This distinction is important because investors' reactions to earnings announcements are likely to differ from their behavior at other times. Our analysis thus contributes to the large literature investigating investor behavior around earnings announcements (Beyer et al. 2010).

Taken together, our results provide compelling evidence on the limitations of investor attention. We find that investors are indeed susceptible to distractions in their reactions to earnings announcements but that this susceptibility is a function of investor type. Specifically, we find that only retail investors exhibit limited attention in response to unexpected distractions around earnings announcements; our evidence suggests that institutional investors ignore unexpected distractions. Consistent with this finding and research on the differential price impacts of these investor classes, we document that unexpected distractions do not appear to impact stock price efficiency around earnings announcements. In doing so, we contribute to the debate on the implications of investor inattention in capital markets (DellaVigna and Pollet 2009; deHaan et al. 2015; Michaely et al. 2016b).

2 Related literature and hypothesis development

Traditional asset pricing models typically assume individuals are unconstrained in their ability to assess a wide array of investments. These models share the view that investors trade immediately as new information arrives, so that prices always fully reflect available information (Black 1972; Jagannathan and Wang 1996; Lintner 1965; Ross 1976; Sharpe 1964). However, more recent evidence questions the accuracy of this assumption (DellaVigna and Pollet 2009; Hirshleifer et al. 2009; Drake et al. 2016). In particular, Kahneman (1973) suggests that attention is a scarce cognitive resource that individuals must allocate selectively. Hirshleifer and Teoh (2003) note that this allocation problem is particularly acute in the context of capital markets, where investors face vast quantities of information. They describe corporate disclosures as examples of stimuli that require investor attention for accurate processing. Other events that coincide with corporate disclosures represent a challenge for attention-constrained investors.

Competing stimuli have been the subject of several recent studies on investor attention (DellaVigna and Pollet 2009; Hirshleifer et al. 2009; Drake et al. 2016), but conclusive evidence of their impact on capital markets remains elusive. DellaVigna and Pollet (2009) suggest that earnings announcements made on Fridays exploit limited attention because weekends distract investors. Consistent with this view, the study reports that earnings announcements made on Fridays engender lower immediate and higher delayed market response. However, subsequent work by deHaan et al. (2015) and Michaely et al. (2016b) finds contradictory results. Using several direct measures of investor attention, deHaan et al. (2015) report no evidence of reduced attention on Fridays. Michaely et al. (2016b) reconcile this finding with earlier evidence of differential market reactions to earnings announcements made on Friday by illustrating that managers disclose different types of information on Fridays.

The conclusions of Michaely et al. (2016b) highlight a critical concern in the identification of competing stimuli: the possibility that managers strategically time

disclosures. This would create a situation in which the information disclosed in conjunction with competing stimuli systematically differs from disclosures on other days. The motivation for this is straightforward: managers would prefer investors to pay more (less) attention to good (bad) news. While Michaely et al. (2016b) illustrate the existence of strategic timing, the concern is more broadly applicable to any measure of competing stimuli that is anticipatable. Hirshleifer et al. (2009), for instance, propose measuring the level of competing stimuli around corporate disclosures using the number of concurrent earnings announcements. They argue that investors' information load on a given day increases with the number of simultaneous earnings announcements made on that day. More recently, Drake et al. (2016) introduce NCAA men's basketball tournament (March Madness) days as a measure of competing stimuli unrelated to investment decisions. While both of these measures plausibly capture scenarios that demand investor attention, they are well-known to managers in advance.[3]

The timing of strategic disclosures complicates analyses of capital markets consequences of limited investor attention. The observed investor reaction to disclosures made in conjunction with anticipatable competing stimuli is a response not only to the stimuli but also to fundamentally different information released by firms. This inhibits disentangling whether the observed reduced attention is due to a distraction or to different types of disclosures. Therefore, the existence of strategic disclosure timing necessitates a measure of competing stimuli that is unanticipated and does not provide value-relevant information. The measure we use, DNP, is superior to those used previously, as it is more plausibly unpredictable and exogenous to investors' valuation decisions. This measure allows us to study how investors' reactions to corporate announcements are sensitive to competing stimuli, absent concerns about strategic disclosure timing. If investors are susceptible to competing stimuli in their processing of corporate disclosures, we should observe a negative association between investor attention and DNP. Therefore, we hypothesize that investor attention to earnings announcements is weaker on days with high levels of unexpected distractions as measured by DNP.

One class of investors likely to have scarce attention is retail investors. For instance, Blankespoor et al. (2018) show that retail investors are motivated to trade by automated "robo-journalism" articles that merely synthesize stale information, suggesting that retail investors might have difficulty collecting and parsing information when it is initially disseminated. In contrast, institutional investors are more likely to efficiently react to corporate news. Consistent with this view, Barber and Odean (2008) show that institutional investors do not engage in attention-based buying and Drake et al. (2016) report that their inferences regarding distraction around

[3]The implementation of Regulation Fair Disclosure ("Reg FD") in 2000 prompted firms to publicly announce in advance their earnings announcement dates. This generates the potential for other firms to incorporate this information into their own disclosure decisions and for investors to anticipate the announcements and adjust their attention accordingly. Consequently, it is plausible that NumEA was a more effective measure of investor distraction during the Hirshleifer et al. (2009) sample period but is now more susceptible to strategic timing.

March Madness are attenuated for firms with large institutional ownership. Therefore we expect that only retail investors will be susceptible to competing stimuli in their processing of corporate disclosures.

One potential implication of the hypothesis that unexpected distractions reduce only retail investor attention is the idea that unexpected distractions may not result in muted price reactions to earnings announcements. The literature offers conflicting inferences on the relation between unexpected distractions and price reactions. On one hand, a hallmark of the investor inattention literature is the conclusion that reduced investor attention leads to weaker price reactions to earnings announcements (DellaVigna and Pollet 2009; Drake et al. 2016). However, the aforementioned challenges related to strategic timing cast doubt on the validity of these inferences Michaely et al., (2016a,b). These studies also often fail to distinguish between investor classes, which matters for understanding price reactions to corporate disclosures.

The relative roles of retail and institutional traders in price discovery is an unresolved question. On the one hand, Grossman and Stiglitz (1980) argue that price efficiency depends critically upon the presence of both informed and uninformed traders. Without uninformed traders to provide liquidity, informed traders face steep transactions costs that limit their ability to trade and incorporate information into prices.[4] Israeli et al. (2017) provide empirical support for this argument, showing that price efficiency increases with the level of uninformed trading. If retail investor attention to corporate announcements is critical to price discovery, we should expect to observe muted price reactions to earnings announcements on high DNP days. On the other hand, some research suggests that institutional investor attention primarily drives observed price reactions to earnings news (Ben-Rephael et al. 2017). One possible explanation for these seemingly conflicting findings is that the presence of retail traders is important for efficient security prices but only up to a certain threshold. This would suggest that, if reduced retail trading activity around announcements on high distraction days still leaves enough retail traders against whom institutional investors can trade, we will observe no difference in price reaction to earnings announcements on high DNP days.

3 Research design

We hypothesize that investor attention to earnings announcements is weaker on days with high levels of unexpected distractions but that this effect is concentrated among retail investors and thus may not affect equilibrium prices. We test these hypotheses using a Daily News Pressure (DNP) index as a measure of the extent to which investors face distractions that are unpredictable by both investors and managers. In

[4]Grossman and Stiglitz (1980) describe a long-run equilibrium where the absence of sufficient noise trading eventually leads to a reduction in costly information acquisition. However, in the case of an unexpected and temporary reduction in noise trading, informed investors may not change their information acquisition. Nonetheless, price efficiency may still be affected by such unexpected and temporary reductions in noise trading through their effect on liquidity provision.

the sections that follow, we outline the construction of DNP and explain the empirical framework we use to test our hypothesis.

3.1 Daily news pressure index

To develop a proxy for the presence of unexpected competing stimuli, we construct a time-series of the DNP index. The notion that investor attention is subject to capacity constraints suggests that less attention can be devoted to a firm-specific announcement when there is more breaking news about other topics. Following Eisensee and Stromberg (2007), we measure the availability of newsworthy material as the median number of minutes across the three main U.S. television news broadcasts (ABC, CBS, and NBC) devoted to the first three news segments in a given day.

To do that, we obtain, from the Vanderbilt Television News Archives, a detailed list of all news segments broadcast by the three networks on their evening news each day between January 1, 1995, and December 31, 2015. We then count, for each network, the total number of seconds spent on the first three news segments (excluding commercials, anchor segments, and program introductions). The daily median number of seconds is then divided by 60 to derive a Daily News Pressure index. Because the duration of the evening news program is 30 minutes, the DNP index will take a value between (close to) zero and 30.[5] Even though DNP itself is based on television broadcasts airing at 5:30 pm (i.e., after market close), we expect that it will be an informative summary statistic for the level of distraction faced by investors during trading hours. Typically the content of television broadcasts is driven by newsworthy events occurring throughout the day, rather than breaking news occurring during the broadcasts themselves. The idea that a market-wide measure like DNP could impact investor attention at the firm level is consistent with the findings of Drake et al. (2017), who document the extent to which firm-specific investor attention can covary with overall market attention. Appendix A provides more details on the construction of the DNP index, including an example of its calculation each day.[6]

Figure 1 plots the DNP index for all trading days between January 1, 1995, and December 31, 2015, and Table 1 provides descriptive statistics. Among the unique trading days in our sample, the mean (median) DNP index is 8.51 (8.17), and the interquartile range is 7.0-9.5. This reveals that news broadcasts generally devote between 7 and 9.5 minutes to the top three news items of the day. The index exceeds 20.0 (i.e., the broadcast devotes more than 20 minutes to the top three news

[5]The Vanderbilt Television News Archives contain evening news broadcasts from the major U.S. national television networks beginning August 5, 1968. We focus on ABC, CBS, and NBC broadcasts because they have retained the same format (i.e., 30 minutes aired between 5:30 pm-6:00 pm) over our sample period, 1995-2015. In contrast, CNN had varying news formats over our sample period, and Fox News is only available after 2004.

[6]In the rare instances where the news broadcast deviates from the normal 30-minute format, typically when extraordinary events occur, we set the index to a missing value. Note, too, that our sample is limited to days when U.S. equity markets are open.

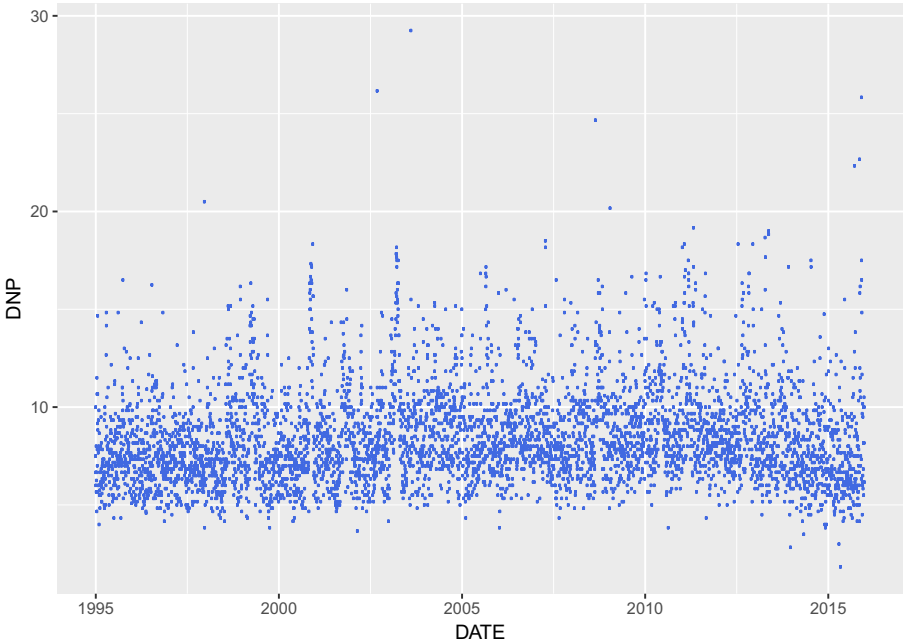

Fig. 1 Daily news pressure (DNP) index between 1995 and 2015. This figure plots the DNP index value for every trading day between 1995 and 2015

items) on only 50 occasions. As Fig. 1 indicates, the index is fairly stable over our sample period, with the vast majority of values falling between 5 and 10. To further address concerns about seasonality in the index, we examine the distribution of DNP by month and day of week in Fig. 2. We find no significant differences among either the means or ranges of DNP when sorted by days of the week or months of the year. This evidence supports the view that the DNP index captures the construct of unexpected distractions and does not exhibit any predictable pattern. Nonetheless, in our tests, we include firm- and day-of-week-fixed effects to ensure our inferences are unaffected by potential firm-specific sensitivity to DNP or cyclicality of distractions as they are measured by DNP.

Consistent with Peress and Schmidt (2020), we assume that DNP offers a measure of investor distraction that is exogenous to earnings announcements.[7] Peress and Schmidt (2020) investigate the causal effect of retail trading on stock market liquidity. They find that DNP exhibits negligible correlation with macroeconomic news, investor sentiment, or other information related to future corporate cash flows or

[7]Peress and Schmidt (2020) examine the highest DNP for each year between 1995 and 2015, along with the main news event on that day. They observe that high values of the index typically coincide with major unexpected news events that seem unrelated to earnings announcements. For example, the highest DNP observation in 2012 (18.33) corresponds to the Sandy Hook Elementary School shooting on December 14, 2012.

Table 1 Descriptive statistics and correlation matrix

Panel A: Descriptive statistics

Statistic	N	Mean	St. Dev.	Pctl(25)	Median	Pctl(75)
DNP	139,874	8.506	2.114	7.000	8.167	9.500
ATVol	139,874	0.316	0.432	0.027	0.258	0.542
Google	49,059	1.978	1.018	1.386	2.303	2.833
ARVol	52,416	0.423	0.460	0.099	0.369	0.711
AIA	14,487	1.305	0.567	1.386	1.609	1.609
CAR[0, 1]	139,874	0.003	0.078	−0.032	0.001	0.036
CAR[2, 60]	139,874	0.006	0.202	−0.095	−0.004	0.089
IPT	104,875	4.164	2.630	2.958	4.227	5.383
SUE	139,874	−0.001	0.057	−0.003	0.001	0.005
Size	139,874	7.163	1.702	6.020	7.046	8.216
BTM	139,874	−0.847	0.763	−1.273	−0.785	−0.359
Analyst	139,874	0.946	0.835	0.000	0.693	1.609
InstOwn	139,874	0.647	0.246	0.494	0.677	0.820

Table 1 (continued)

Panel B: Correlation matrix

	DNP	ATVol	Google	ARVol	AIA	CAR[0,1]	CAR[2,60]	IPT	SUE
DNP		0.01	–0.023	–0.066	–0.062	–0.001	–0.002	0.017	0.007
ATVol	0.02		0.053	0.767	0.134	–0.02	0.028	0.237	0.027
Google	–0.03	0.056		0.068	0.156	–0.009	–0.007	0.023	–0.003
ARVol	–0.067	0.773	0.067		0.117	0.018	0.025	0.226	0.02
AIA	–0.102	0.16	0.183	0.126		–0.014	–0.014	0.053	–0.03
CAR[0,1]	0.001	0.015	–0.009	0.013	–0.016		0.021	0.021	0.064
CAR[2,60]	–0.001	0.025	0.001	0.022	–0.008	0.026		–0.002	0.003
IPT	0.028	0.334	0.038	0.3	0.06	0.023	–0.001		0.007
SUE	0.021	0.053	0.009	0.052	–0.045	0.142	0.033	0.007	

Panels A and B provide descriptive statistics and a correlation matrix for the main variables in our analyses. In Panel B, Pearson (Spearman) correlations are reported above (below) the diagonal. All variable definitions appear in Appendix B

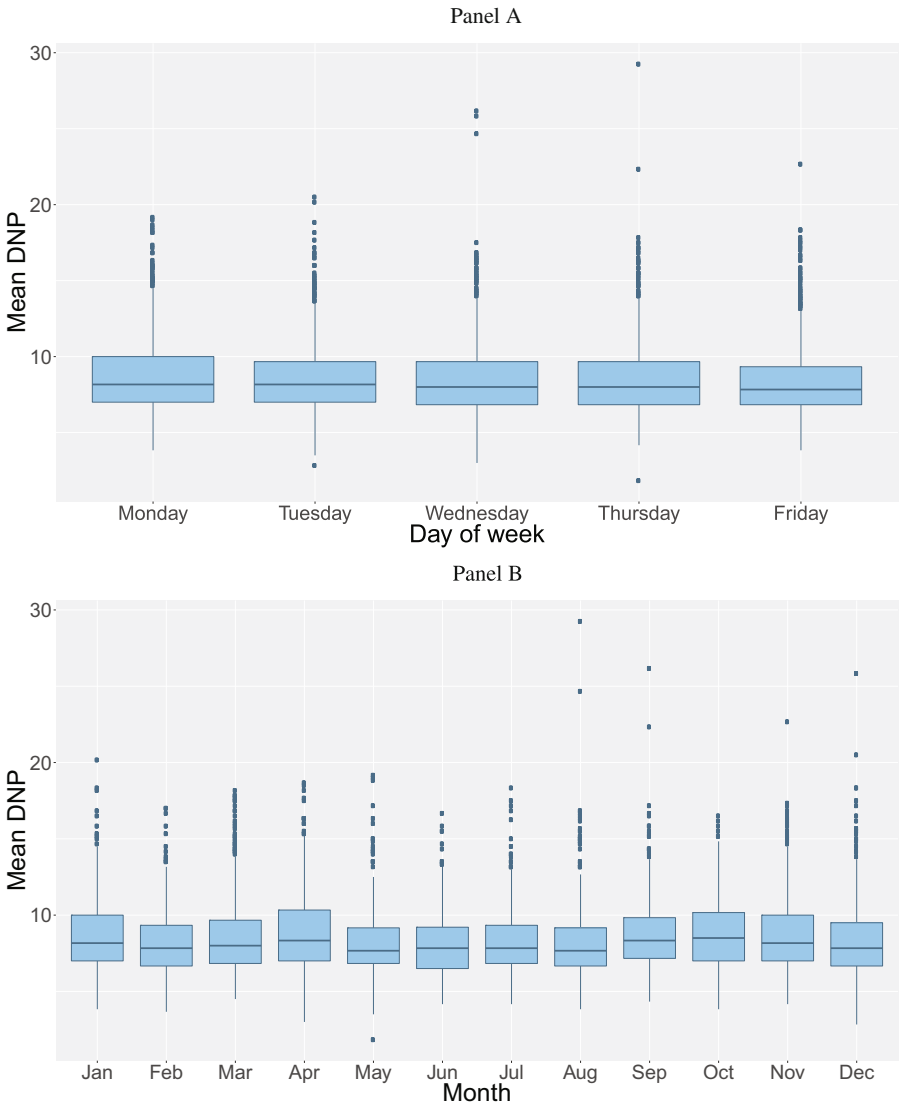

Fig. 2 Distribution of the daily news pressure (DNP) index by day and month. Panel A (B) provides a distribution of DNP by days of the week (months of the year)

Table 2 Likelihood of reported loss by level of investor distraction

Panel A: DNP			
Announcement day DNP rank			
Top Decile	Bottom Decile	Diff.	*p*-val.
0.1686	0.1674	0.0012	0.786
Panel B: Friday			
Announcement day of week			
Friday	Non-Friday	Diff.	*p*-val.
0.1887	0.1619	0.0269	0.000
Panel C: NumEA			
Announcement day NumEA rank			
Top Decile	Bottom Decile	Diff.	*p*-val.
0.1533	0.1861	–0.0328	0.000
Panel D: NCAA			
Announcement day			
NCAA	Non-NCAA	Diff.	*p*-val.
0.2112	0.1659	0.0453	0.013

This table presents the likelihood of a reported loss on days with high and low investor distraction. We consider four measures of investor distraction: daily news pressure (DNP) in Panel A, Friday announcements (Friday) in Panel B, number of concurrent earnings announcements (NumEA) in Panel C, and NCAA March Madness tournament announcements (NCAA) in Panel D. In each panel, the column "Diff." presents the difference in the likelihood of a reported loss between high and low distraction periods, and the column "*p*-val." presents the *p*-value from a t-test of the null hypothesis that the difference equals zero. All variable definitions appear in Appendix B

discount rates.[8] This finding, together with the distributional statistics presented in our study, suggests that variation in the DNP measure is unrelated to firm-specific information contained in earnings announcements.

A key feature of our identification strategy is the notion that the news events reflected in our measure of distraction are unpredictable by both investors and managers. Thus, unlike studies that use predictable measures of investor distraction (e.g., Fridays, contemporaneous earnings announcements, and scheduled sporting events), our tests are less likely to suffer from a potential self-selection bias related to firms' strategic disclosure choices. We recognize there may be instances where high news pressure is predictable, such as around recurring political and sporting events. To confirm that managers do not strategically disclose different types of information based

[8]Specifically, Peress and Schmidt (2020) show that DNP is not significantly correlated with the Baker et al. (2016) measure of economic policy uncertainty, the Aruoba et al. (2009) index of business activity, instances of Federal Open Market Committee meetings, or with releases of the Consumer Price Index or U.S. employment statistics from the Bureau of Labor Statistics. They find weak evidence of an association between DNP and the NYT sentiment index, supporting the view that DNP relates somewhat to mood. However, the economic magnitude of this relation is quite small. Even when used together, these six indices explain less than 10% of variation in DNP.

upon the anticipated level of DNP, we examine whether the likelihood of a manager reporting a loss systematically differs according to the level of DNP on the announcement day. Panel A of Table 2 reveals that the likelihood of a manager reporting a loss is statistically indistinguishable on days with high and low levels of DNP. Specifically, the likelihood of a manager reporting a loss is 16.86% and 16.74% on days with high and low DNP, respectively. The difference between these likelihoods, 0.12%, is statistically indistinguishable from zero (p-val = 0.786).

For comparison, we also consider how the likelihood of a manager reporting a loss varies across alternate measures of competing stimuli commonly used in the literature, which are more likely to suffer from potential strategic disclosure concerns. In Panel B of Table 2, we consider the incidence of earnings announcements on Fridays as a measure of competing stimuli. Consistent with the work of Michaely et al. (2016b), who argue that managers strategically disclose different types of information on Fridays, we find that Friday earnings announcements are significantly more likely to be losses than earnings announcements made on other days of the week. Similarly, in Panel C of Table 2, we consider the number of concurrent earnings announcements (NumEA) as a measure of competing stimuli, following Hirshleifer et al. (2009). We find that earnings announcements made on days with few concurrent announcements are significantly more likely to be losses than earnings announcements made on days with many concurrent announcements. This is consistent with the inferences of Johnson and So (2018) that managers strategically schedule earnings announcements based upon their content.[9] Finally, in Panel D, we consider NCAA March Madness tournament days (NCAA) as a measure of competing stimuli. We find that the likelihood of a manager reporting a loss is significantly higher on these days than on nontournament days. This supports the observation that NCAA days are foreseen and suggests that managers may try to "hide" bad earnings news on these days. Overall, our results indicate that our proposed measure of competing stimuli, DNP, is less susceptible to concerns about strategic disclosure timing than other measures.[10]

3.2 Measures of investor attention

3.2.1 Overall trading volume and Google searches

We predict that investor attention to earnings announcements decreases with the incidence of unexpected distractions during the announcement period. We use overall

[9]Our finding that managers disclose fewer losses on high NumEA days may initially seem counterintuitive, given the popular interpretation of high NumEA days as high distraction days. However, our results in Section 5.1 cast doubt on this view, as we find that high NumEA days are associated with more retail investor attention per unit of earnings news. To the extent that there is more attention on high NumEA days, it might benefit managers to strategically disclose losses on low NumEA days. More generally, we emphasize the systematic difference in loss incidence across levels of NumEA, as this illustrates the strategic timing concern that challenges the use of NumEA in studies of investor distraction around corporate disclosures.

[10]In untabulated analyses, we also find that there is no significant difference in the proportion of negative management forecasts on high DNP days, relative to other disclosure days.

trading volume and Google searches to measure the level of investor trading and interest in a firm's stock when the firm releases an earnings announcement. We assume that these measures are monotonically increase with investor attention to firm-specific news. Consequently, our hypothesis is that these measures are negatively associated with DNP.

A substantial literature establishes the validity of overall trading volume as a measure of investor attention (Bamber et al. 2011; Israeli et al. 2021; Verrecchia 2001). For example, the seminal work by Beaver (1968) documents a significant increase in overall trading volume around earnings announcements, which he attributes to differential beliefs about a firm's value or differential risk preferences. A necessary condition for such differences to arise is that investors are paying attention to the announcement being made. We believe overall trading volume is a particularly good proxy for investor attention in our setting, since it isolates attention from equity investors–as opposed to the general public–and reflects the actions taken by those investors. As Bamber et al. (2011) notes, overall trading volume "arguably provides the most direct evidence that disclosure has affected individual investors."

We define abnormal overall trading volume ($ATVol_{i,t}$) as the difference between the natural logarithm of one plus the average share turnover ratio for firm i across days [0, 1], scaled by the average daily turnover ratio over days [-54, -5], relative to earnings announcement day t, and an analogous amount for all firms traded on major stock exchanges in the United States, as follows.

$$ATVol_{i,t} = \ln\left(1 + \frac{\frac{1}{2}\sum_{j=0}^{1} TR_{i,t+j}}{\frac{1}{50}\sum_{j=5}^{54} TR_{i,t-j}}\right) - \ln\left(1 + \frac{\frac{1}{2}\sum_{j=0}^{1} TR\_Mkt_{i,t+j}}{\frac{1}{50}\sum_{j=5}^{54} TR\_Mkt_{i,t-j}}\right)$$

$TR_{i,t+j}$ ($TR\_Mkt_{i,t+j}$) denotes share turnover ratio of firm i (all firms traded on major stock exchanges in the United States) on day $t + j$, relative to announcement day t.

In using overall trading volume to construct a measure of investor attention, we make the relatively straightforward but nonetheless critical assumption that investors are more likely to trade a particular stock when they pay more attention to it. To the extent that investors trade mechanically or pay attention to a stock but decide not to trade, our use of overall trading volume will measure investor attention with an error. For instance, deHaan et al. (2015) suggest that the relation between attention and overall trading volume is based on an equilibrium concept that may be violated by the limited attention bias. To mitigate this concern, we also consider Google searches as a complementary measure of investor attention. Google searches allow us to capture a dimension of investor attention that may not be reflected in overall trading volume.

We define abnormal Google search volume ($Google_{i,t}$) as the natural logarithm of the rank of average daily Google search volume index (SVI) across days [0, 1], with respect to the daily Google SVI over days [-30, -1], relative to earnings announcement day t. Following Da et al. (2011) and Drake et al. (2012), we measure the

Google SVI of individual firm tickers.[11] Chi and Shanthikumar (2017) note that there are geographical biases in Google searches. Because we focus on analyzing investor attention to earnings announcements made by U.S. firms, we only include searches originating in the United States in the construction of $Google_{i,t}$. Restrictions on data availability require us to use the fixed-scaling Google search data and obtain measures of Google SVI in 90 day windows, where each value in a given window is relative to the starting date of the window. Since data across search windows are not comparable, we apply the ranking procedure to measure the level of attention to a firm's earnings announcement, as reflected in Google searches within a particular search period.

We examine the effect of DNP on these two measures of investor attention by estimating the following equations.

$$ATTN_{i,t} = \beta_1 AbsSUE_{i,t} + \beta_2 DNP_t + \alpha Controls_{i,t} + \gamma_i + \delta_t + \epsilon_{i,t} \quad (1a)$$

$$ATTN_{i,t} = \beta_1 AbsSUE_{i,t} + \beta_2 DNP_t + \beta_3 DNP_t \times AbsSUE_{i,t} + \alpha Controls_{i,t} + \gamma_i + \delta_t + \epsilon_{i,t} \quad (1b)$$

In these equations, $ATTN_{i,t}$ denotes the level of market attention, measured as either abnormal overall trading volume (ATVol) or abnormal Google searches (Google) for firm i over days [0, 1] relative to earnings announcement day t. $AbsSUE_{i,t}$, denotes the absolute value of the firm's standardized unexpected earnings (SUE) on earnings announcement day t, which we include as a measure of the information content of the announcement. Following Livnat and Mendenhall (2006), we calculate $\text{SUE}_{i,t}$ for firm i in quarter t as follows.

$$SUE_{i,t} = \frac{Earn_{i,t} - Earn_{i,t-4}}{P_{i,t}}$$

$Earn_{i,t}$ is quarter t net income reported by firm i, and $P_{i,t}$ is firm i's stock price at the end of quarter t. In the context of investor attention, we take the absolute value of SUE because the attention variables that we use are nondirectional. Following Hirshleifer et al. (2009), we exclude SUE observations when $Earn_{i,t} - Earn_{i,t-4}$ exceeds $P_{i,t}$ to minimize possible data errors. DNP_t, our main variable of interest, is the average of the DNP index over days [0, 1] relative to earnings announcement day t. We hypothesize that investor attention to earnings announcements is lower on days with larger distractions. Hence we predict that, in Eq. 1a, the coefficient β_2 on DNP_t will be negative. Because the effect of distractions on investor attention

[11] Da et al. (2011) justify the use of tickers, rather than full company names, by noting that tickers are "less ambiguous" and relatively more likely be used by investors interested in financial information than searches for full company names, which are often the result of searches for nonfinancial information. Nonetheless, deHaan et al. (2019) describe a specific form of measurement error that likely affects the Google SVI variable and outline several procedures to mitigate the impact of this error on statistical inferences. Following deHaan et al. (2019), we replicate our analyses using a reduced sample of firms whose tickers are less "noisy," and thus Google SVI is less likely to suffer from measurement error. We use the two approaches suggested by deHaan et al. (2019) to identify these noisy tickers. First, we exclude all tickers with fewer than four characters, and we then exclude all tickers that appear on deHaan et al. (2019)'s list of common words. Using either of these reduced samples, we continue to find a statistically and economically significant negative association between DNP and the level of Google SVI. This reassures us that our main inferences are not attributable to measurement error in Google SVI.

may be only observable when earnings announcements contain news that motivates investors to trade, we also estimate Eq. 1b. This equation includes the interaction of DNP_t with $AbsSUE_{i,t}$, as an additional variable, allowing us to examine how the relationship between measures of attention and DNP changes with the magnitude of new information arriving in the market. We predict that the coefficient β_3 on this interactive term will be negative.

In the $Controls_{i,t}$ vector, we include several nonstatic firm characteristics that research finds to be correlated with investor attention: firm size ($Size_{i,t}$), equity book-to-market ratio ($BTM_{i,t}$), analyst coverage ($Analyst_{i,t}$), and level of institutional ownership ($InstOwn_{i,t}$) for a given quarterly earnings announcement date. We measure $Size_{i,t}$ as the natural logarithm of the market value of equity for firm i on day t. $Analyst_{i,t}$ is defined as the natural logarithm of one plus the number of analysts issuing an earnings forecast for firm i in a given month, and $InstOwn_{i,t}$ is defined as the number of a firm i's shares held by institutions, scaled by the total number of shares outstanding as of the most recent quarter-end.

γ_i denotes firm fixed effects that capture time-invariant differences in investor attention across firms and allows us to identify the effect of DNP on measures of attention using within-firm variation. δ_t is a vector that indicates day-of-week and year fixed effects to accommodate potential within-week and within-year variations in investor attention to earnings announcements. Since this involves the inclusion of a Friday fixed effect, this approach also addresses concerns about the potential effect of distractions on Fridays (DellaVigna and Pollet 2009). We base our inferences on t-statistics computed using robust standard errors clustered by both firm and day.

3.2.2 Retail trading volume and Bloomberg searches

Our second hypothesis predicts that reduced investor attention to earnings announcements is concentrated among retail investors. To estimate retail trading volume around earnings announcements, we adopt the methodology outlined by Boehmer et al. (2021) and Blankespoor et al. (2018) to distinguish trades involving retail investors in the NYSE Trade and Quote (TAQ) database. TAQ assigns exchange code "D" to all trades reported to a FINRA Trade Reporting Facility (TRF). These trades are almost all either retail trades or institutional dark-pool trades, and it is possible to distinguish between them by examining the price improvement of the trade. Boehmer et al. (2021) report that institutional trades usually occur at the penny or half-penny, while retail trades are more likely to receive a small fractional-cent price improvement, relative to National Best Bid and Offer. By excluding all trades that occur at the penny or half-penny, we can identify a portion of overall trading volume that results exclusively from retail trading.[12]

Similar to $ATVol_{i,t}$, abnormal retail trading volume ($ARVol_{i,t}$) is computed as the difference between the natural logarithm of one plus the average retail shares

[12] Blankespoor et al. (2018) note that this approach offers low type I and high type II errors. In other words, using this approach we are unlikely to misclassify trades as retail but probably are not capturing the full extent of retail trading.

traded over days [0, 1], scaled by the firm's trailing retail trading volume average over days [-54, -5], relative to announcement day t, and an analogous amount for all firms traded on major stock exchanges in the United States. Due to the availability of TAQ data, we can only estimate $ARVol_{i,t}$ from 2003 to 2015. We estimate Eqs. 1a and 1b using $ARVol_{i,t}$ as the dependent variable to test whether DNP is associated with reduced retail investor attention to earnings announcements. If retail investor attention is lower in the presence of unexpected distraction, then, when $ARVol_{i,t}$ is the dependent variable, the coefficient estimates on DNP_t in Eq. 1a and on the interaction between DNP_t and $AbsSUE_{i,t}$ in Eq. 1b will be negative.

We also test how institutional investor attention to earnings announcements is affected by unexpected distractions. To do that, we estimate Eqs. 1a and 1b, using abnormal institutional attention ($AIA_{i,t}$) as the dependent variable. As Ben-Rephael et al. (2017) describe, $AIA_{i,t}$ measures the level of news searching and viewing activity for firm i on day t by users on Bloomberg terminals. Specifically, every hour, Bloomberg assigns a score of 0, 1, 2, 3 or 4 if that hour's search activity is below 80%, between 80% and 90%, between 90% and 94%, between 94% and 96%, or greater than 96% of the previous 30 days' hourly activity, respectively. These hourly scores are then aggregated to the daily frequency by taking a maximum of all hourly scores throughout the calendar day. $AIA_{i,t}$ thus provides a relative measure of institutional investor attention, to the extent that institutional investors are the primary users of Bloomberg terminals.[13] Due to the availability of Bloomberg data, we can only estimate $AIA_{i,t}$ from 2010 to 2015. If unexpected distractions do not impact institutional investor attention to earnings announcements, the coefficient estimates on DNP_t in Eq. 1a and on the interaction between DNP_t and $AbsSUE_{i,t}$ in Eq. 1b will be indistinguishable from 0 when $AIA_{i,t}$ is the dependent variable.[14]

3.3 Measures of price reactions around earnings announcements

Our third hypothesis relates to price reactions around earnings announcements. We consider two dimensions of price reaction in our analyses: 1) the magnitude of returns both during the announcement and immediately thereafter and 2) the speed of price

[13] Ben-Rephael et al. (2017) provide several evidence for the claim that institutional investors are the primary users of Bloomberg terminals. First, they note that Bloomberg has approximately 325,000 terminal subscriptions that range in cost from $20,000 to $25,000 per year, a level that would be prohibitive for most non-institutional investors. Second, they examine the user profiles of terminal subscribers and find that approximately 80% of them work in financial industries. Academic users constitute less than 1% of the user base, and the remainder are largely Bloomberg employees.

[14] Note that, in measuring institutional investor attention, we use a measure of investor demand for information rather than a measure based on trading volume. This is due to limitations on data availability. In particular, one cannot interpret the difference between overall trading volume and our measure of retail trading volume as a measure of institutional trading volume. As previously noted, ARVol offers low type I and high type II errors so that we are unlikely to misclassify trades as retail but probably are not capturing the full extent of retail trading. We believe that our approach of using retail trading volume and institutional investor searches provides the best strategy for minimizing type I error in identifying investor attention across these two groups. Moreover, recognizing that our measures are imperfect, we also bolster our analyses by including several controls and fixed effects.

discovery. We measure abnormal cumulative stock returns, defined as the difference between the buy-and-hold return of the announcing firm and that of a size and book-to-market matching portfolio, over two windows: days [0, 1] and days [2, 60], relative to the earnings announcement. The first window allows us to measure the announcement-period return, which we expect to increase with the extent to which the earnings signal is informative and prices are efficient. The second window allows us to measure the degree of post-earnings-announcement drift in each firm's stock price; the literature reports that such drift primarily occurs during the first 60 trading days after the announcement. Our third measure is an intraperiod timeliness (IPT) metric that measures the speed of price discovery around earnings announcements (Butler et al. 2007; Blankespoor et al. 2018; Cheng et al. 2017; Twedt 2016). The literature defines IPT as the area under the curve generated by plotting abnormal cumulative returns against time and interprets this as an estimate of the speed with which earnings announcement news is impounded into a firm's stock price. The literature commonly estimates IPT over days [0, 5] relative to the earnings announcement, as follows.

$$\text{IPT} = \sum_{j=0}^{4} \frac{CAR[0, j]}{CAR[0, 5]} + 0.5$$

$CAR[0, j]$ denotes abnormal cumulative stock returns over days [0, j], relative to a firm's earnings announcement date.[15]

Similar to our tests of investor attention, we explore the relation between DNP and price efficiency both unconditionally and conditional upon the amount of information that arrives in each firm's earnings announcement. We do so by estimating the following equations.

$$PR_{i,t} = \beta_1 SUE_{i,t} + \beta_2 DNP_t + \alpha Controls_{i,t} + \gamma_i + \delta_t + \epsilon_{i,t} \quad (2a)$$

$$PR_{i,t} = \beta_1 SUE_{i,t} + \beta_2 DNP_t + \beta_3 DNP_t \times SUE_{i,t} + \alpha Controls_{i,t} + \gamma_i + \delta_t + \epsilon_{i,t} \quad (2b)$$

In Eqs. 2a and 2b, the dependent variable $PR_{i,t}$ is one of our three measures of price reaction: announcement-period stock returns ($CAR[0, 1]_{i,t}$), post-earnings-announcement drift ($CAR[2, 60]_{i,t}$), and intraperiod timeliness ($IPT_{i,t}$). Following the literature, including DellaVigna and Pollet (2009), Hirshleifer et al. (2009) and Michaely et al. (2016b), all explanatory variables in Eqs. 2a and 2b appear in decile ranks based on calendar quarter rankings.[16]

In Eq. 2a, our main variable of interest is DNP_t. Equation 2b includes the interaction of DNP_t with $SUE_{i,t}$ as an additional variable, which allows us to examine how the relation between price efficiency and DNP changes with the magnitude of new information arriving in the market. If reduced retail investor attention does not materially impact price discovery, β_2 and β_3 will be indistinguishable from zero.

[15] Following the literature, in our IPT tests, we exclude observations with absolute $CAR[0, 5]$ of less than 2% to reduce measurement noise due to a small denominator. Our inferences are the same if we do not apply this filter.

[16] Our inferences are the same if, in Eqs. 2a and 2b, we use the levels of explanatory variables and not their decile ranks.

As before, $Controls_{i,t}$ denotes a vector of control variables, γ_i denotes firm fixed effects, and δ_t indicates day-of-week and year fixed effects. Our inferences from the estimation of Eqs. 2a and 2b are based on t-statistics computed using standard errors clustered by both firm and day.

4 Data and findings

4.1 Sample construction

We construct our sample by first identifying the set of firms listed on the New York (NYSE), American (AMEX), and NASDAQ stock exchanges with available quarterly earnings announcement dates and a share code of '10' or '11' in CRSP. We start our sample in 1995 following DellaVigna and Pollet (2009) and Hirshleifer et al. (2009), who assert that, before 1995, many earnings announcements were recorded with errors. We identify earnings announcement days using the Compustat, CRSP, and IBES databases following the methodology outlined by DellaVigna and Pollet (2009) to address potential inaccuracies in the reported announcement dates across databases.

To ensure our inferences are not affected by firms with low stock prices or unique accounting conditions, we remove observations with stock prices below $1 or negative book values of equity. In addition, to better quantify the information content of earnings announcements, we remove observations where the earnings announcement date coincides with a dividend announcement date. These procedures, along with requirements for data availability on CRSP to compute our trading volume and price efficiency variables, yield a final sample of 139,874 quarterly earnings announcements made by 3,405 firms from January 1, 1995, to December 31, 2015. For some types of analyses, data are available only for more recent years, and hence the sample used in such cases is smaller.[17]

Panel A of Table 1 provides descriptive statistics for our sample observations. Many of the variables in our analyses are used in logarithmic form, which makes direct interpretation of their mean values uninformative. Therefore, in the following description, we discuss their untransformed values for easier interpretation. The average observation in our sample has a market value of equity of $1,290.8 million, a book-to-market ratio of 0.43, is followed by 2.58 analysts, and has 64.7% of its shares held by institutional investors. Mean SUE is close to 0, which suggests that earnings announcements, on average, comport with investors' expectations. However, the standard deviation of SUE is 0.057, which reveals large variation in the amount of new information that arrives via earnings announcements. The mean of ATVol is 1.372; this implies that, on average, the overall trading volume of a firm that announces earnings is 37.2% higher than the average trading volume of all publicly traded stocks on the same days. Google has a mean of 7.73 and interquartile range of

[17] Specifically, Google search volume data is available starting in 2005, retail trading volume is available starting in 2003, and Bloomberg search volume is available starting in 2010.

4 to 17, which suggests substantial variation in the relative amount of Google search around earnings announcements. The average observation in our sample has ARVol of 1.527, implying that, on average, the retail trading volume of a firm that announces earnings is 52.7% higher than the average retail trading volume of all publicly traded stocks on the same days.

Panel B of Table 1 reports the Pearson and Spearman correlations among our main variables of interest. It reveals that our measure of unexpected distraction exhibits negligible levels of correlation with SUE (Pearson corr. = 0.007) and with measures of announcement-period returns (Pearson corr. = −0.001). Panel B also provides preliminary evidence of negative association of DNP with retail trading volume (Pearson corr. = −0.066). However, these associations do not control for other variables that affect measures of attention and price efficiency around earnings announcements, such as time-invariant firm-characteristics or year and weekday-specific effects.

4.2 Unexpected distractions and investor attention

4.2.1 Tests of overall trading volume and Google searches

Table 3 presents regression summary statistics of Eqs. 1a and 1b using the level of abnormal overall trading volume, ATVol, and the rank of Google searches, Google, as proxies for investor attention. Consistent with the literature and the notion that SUE captures the magnitude of information in the announcement, we find that the coefficient on AbsSUE is positive and significant in columns (1), (2), and (3). More importantly for our research question, in column (1), we also observe a significantly negative coefficient on DNP. The coefficient estimate suggests that a one standard deviation increase in the level of distraction on a firm's earnings announcement day is associated with a 1.16 percentage point reduction in overall trading volume.[18] Given that trading volume is 37.2% higher around earnings announcements, relative to the non-announcement periods, this effect implies a 3.12% reduction in overall investor attention to earnings announcements on high distraction days.

Column (2) of Table 3 presents regression summary statistics of Eq. 1b, which allows us to quantify the effect of unexpected distractions on trading volume as a function of the amount of news contained in each earnings announcement. Column (2) reveals that the negative association between DNP and abnormal trading volume is stronger when we consider the amount of news that arrives in a firm's earnings announcement. Specifically, coefficient estimates on DNP and AbsSUE×DNP indicate that a one standard deviation increase in DNP is associated with a 2.34% reduction in overall trading volume and this reduction is increasing by 1.15 per-

[18] We obtain the estimate -1.16 by calculating the following product: $-0.004 \times 2.114 \times 1.372$. −0.004 is the estimated coefficient on DNP, and 2.114 is the standard deviation of DNP; 1.372 is the mean raw (i.e., not log-transformed) value of ATVol in our sample ($1.372 = e^{0.316}$)

Table 3 Abnormal overall trading volume and Google searches

	Dependent variable:			
	ATVol		Google	
	(1)	(2)	(3)	(4)
AbsSUE	0.117***	0.360***	0.788***	0.510
	(0.027)	(0.088)	(0.098)	(0.324)
DNP	−0.004***	−0.003***	−0.006**	−0.006**
	(0.001)	(0.001)	(0.002)	(0.003)
DNP × AbsSUE		−0.028***		0.032
		(0.009)		(0.036)
Size	0.021***	0.021***	0.143***	0.143***
	(0.003)	(0.003)	(0.020)	(0.020)
BTM	−0.020***	−0.020***	0.053***	0.053***
	(0.004)	(0.004)	(0.016)	(0.016)
Analyst	−0.039***	−0.039***	−0.002	−0.002
	(0.002)	(0.002)	(0.007)	(0.007)
InstOwn	0.119***	0.119***	0.077	0.077
	(0.014)	(0.014)	(0.051)	(0.051)
Day of week FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	139,874	139,874	49,059	49,059
Adjusted R^2	0.166	0.166	0.380	0.380

This table presents regression results from the estimation of Eqs. 1a and 1b using abnormal trading volume (ATVol) and abnormal Google searches (Google) as dependent variables. Two-way firm and date cluster robust standard errors are in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%. All variable definitions appear in Appendix B

centage points for each one standard deviation increase in AbsSUE. [19] Untabulated statistics show that the sum of the coefficients on DNP and DNP×AbsSUE, -0.031, is significantly negative (F-stat. = 12.7, p-val. = 0.000), suggesting that overall investor attention is weaker on days with high levels of DNP, regardless of the level of AbsSUE.

Columns (3) and (4) of Table 3 present regression summary statistics of Eqs. 1a and 1b, where the proxy for investor attention is the rank of Google searches (Google). Consistent with our hypothesis, we observe a significantly negative coefficient on DNP across both specifications, indicating that firms experience relatively

[19] We obtain the estimate -1.15 by calculating the following: (−0.028 × 2.114 × 0.0539) ÷ 0.372. −0.028 is the estimated coefficient on DNP×AbsSUE; 2.114 is the standard deviation of DNP; 0.0539 is the standard deviation of AbsSUE; 0.372 is the percentage increase in trading volume around earnings announcements, relative to the non-announcement periods.

lower Google search volume in response to their earnings announcements when investors face high levels of unexpected distraction. Note that, in column (4), the coefficient on the interaction between DNP and AbsSUE is not significantly negative. The lack of significance might suggest that the negative association between DNP and Google is not a function of the level of information contained in an earnings announcement. Overall, the results in Table 3 support our hypothesis that investors pay less attention to earnings announcements when those announcements occur on days with greater distraction.

4.2.2 Tests of retail trading volume and Bloomberg searches

Table 4 presents regression summary statistics of Eqs. 1a and 1b using the level of abnormal retail trading volume (ARVol) and abnormal institutional attention (AIA)

Table 4 Abnormal retail trading volume and Bloomberg searches

	Dependent variable:			
	ARVol		AIA	
	(1)	(2)	(3)	(4)
AbsSUE	0.156***	0.473***	0.058	0.366
	(0.043)	(0.147)	(0.107)	(0.282)
DNP	−0.011***	−0.010***	0.003	0.004
	(0.003)	(0.003)	(0.003)	(0.003)
DNP × AbsSUE		−0.036**		−0.036
		(0.015)		(0.035)
Size	0.034***	0.034***	0.100***	0.100***
	(0.007)	(0.007)	(0.022)	(0.022)
BTM	−0.011	−0.011	−0.012	−0.012
	(0.007)	(0.007)	(0.013)	(0.013)
Analyst	−0.034***	−0.034***	0.017**	0.017**
	(0.004)	(0.004)	(0.007)	(0.007)
InstOwn	0.110***	0.109***	0.149**	0.148**
	(0.025)	(0.025)	(0.066)	(0.066)
Day of week FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	52,416	52,416	14,487	14,487
Adjusted R^2	0.198	0.199	0.408	0.408

This table presents regression results from the estimation of Eqs. 1a and 1b using abnormal retail trading volume, (ARVol) and abnormal institutional attention (AIA) as dependent variables. Two-way firm and date cluster robust standard errors are in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%. All variable definitions appear in Appendix B

as proxies for retail and institutional investor attention, respectively. Column (1) of Table 4 reveals a negative relation between ARVol and DNP. The coefficient estimate on DNP suggests that a one standard deviation increase in the level of distraction on a firm's earnings announcement day is associated with a 3.75 percentage point reduction in retail trading volume. Given that our measure of retail trading volume is 52.7% higher around earnings announcements, relative to non-announcement periods, this effect implies a 7.12% reduction in retail investor attention to earnings announcements on high distraction days.

Column (2) of Table 4 presents regression summary statistics of equation (1b). Coefficient estimates on DNP and AbsSUE×DNP indicate that the negative association between DNP and retail trading volume increases with the amount of news that arrives via a firm's earnings announcement. A one standard deviation increase in DNP is associated with a 6.47% reduction in retail trading volume, and this reduction grows by 1.34 percentage points for each one standard deviation increase in AbsSUE. Consistent with the view retail investors pay less attention on days with high levels of DNP, regardless of the level of AbsSUE, untabulated statistics show that the sum of the coefficients on DNP and DNP×AbsSUE, -0.046, is significantly negative (F-stat. = 8.92, p-val. = 0.003). We interpret this result as evidence that the reduced attention to DNP is not attributable to less information being disclosed on these days. Our findings suggest that, if unexpected distractions happen to coincide with more informative announcements, retail investors miss out on more news because of this distraction.

Columns (3) and (4) of Table 4 present regression summary statistics of Eqs. 1a and 1b using abnormal institutional attention as the dependent variable. We find that the coefficient estimate on DNP is indistinguishable from zero in either estimation. Similarly, the interaction between DNP and AbsSUE does not exhibit any significant relation with AIA. The lack of statistical significance suggests that, unlike retail investors, institutional investors do not vary their attention to earnings announcements when faced with unexpected distractions. Overall, the results in Table 4 support our hypothesis that the reduced investor attention to earnings announcements documented in Table 3 is driven by retail but not institutional investors.

4.3 Unexpected distractions and price reactions to earnings announcements

Table 5 presents regression summary statistics of Eqs. 2a and 2b using announcement and post-earnings-announcement period abnormal stock returns, CAR[0, 1] and CAR[2, 60], as dependent variables. Consistent with the literature, the coefficient on SUE is significantly different from zero in all specifications. This suggests that SUE captures a measure of earnings news to which investors react (columns (1) and (2), when CAR[0, 1] is the dependent variable) and that is associated with post-earnings-announcement drift in stock returns (columns (3) and (4), when CAR[2, 60] is the dependent variable).

Consistent with the view that unexpected distractions affect the attention of retail investors but still leave enough retail traders against whom institutional investors can

Table 5 Announcement and post-announcement stock returns

	Dependent variable:			
	CAR[0, 1]		CAR[2, 60]	
	(1)	(2)	(3)	(4)
SUE	0.004***	0.004***	0.002***	0.002***
	(0.0001)	(0.0002)	(0.0002)	(0.001)
DNP	0.00002	−0.00005	0.0001	0.00001
	(0.0001)	(0.0002)	(0.0002)	(0.001)
DNP × SUE		0.00001		0.00001
		(0.00003)		(0.0001)
Size	−0.003***	−0.003***	−0.022***	−0.022***
	(0.0003)	(0.0003)	(0.001)	(0.001)
BTM	0.001***	0.001***	0.001	0.001
	(0.0002)	(0.0002)	(0.0005)	(0.0005)
Analyst	0.0004***	0.0004***	0.001***	0.001***
	(0.0001)	(0.0001)	(0.0003)	(0.0003)
InstOwn	0.0001	0.0001	−0.002***	−0.002***
	(0.0002)	(0.0002)	(0.0005)	(0.0005)
Day of week FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	139,874	139,874	139,874	139,874
Adjusted R^2	0.029	0.029	0.024	0.024

This table presents regression results from the estimation of Eqs. 2a and 2b using announcement-period abnormal stock returns (CAR[0, 1]) and post-announcement-period abnormal stock returns (CAR[2, 60]) as dependent variables. All independent variables are in decile rank form.Two-way firm and date cluster robust standard errors are in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%. All variable definitions appear in Appendix B

trade to impound earnings news into stock prices, the coefficient on DNP is indistinguishable from zero in all specifications. Moreover, as columns (2) and (4) show, the coefficient on the interaction between DNP and SUE is statistically not different from zero. This indicates that the lack of a relation between DNP and the two measures of price reaction endures, regardless of the amount of news contained in an earnings announcement. The insignificance of coefficients on DNP and DNP×SUE supports the view that the reduced attention from retail investors does not lead to less efficient prices around earnings announcements made on days with unexpected distractions, for any level of earnings news. Overall, the evidence in Table 5 suggests that, when

unexpected distractions arrive , enough institutional and retail investors continue to trade, and their trading impounds earnings information in stock prices. [20]

Table 6 presents regression summary statistics of Eqs. 2a and 2b, using the intraperiod earnings timeliness (IPT) as the dependent variable. This estimation allows us to examine how unexpected distractions impact the speed of price discovery around earnings announcements. We observe positive and significant coefficients on Size and InstOwn, which confirms the intuition that price discovery is faster for larger firms and those with more institutional ownership. Moreover, we find that the coefficient on DNP is indistinguishable from zero in columns (1) and (2). This indicates that unexpected distractions are not associated with a deterioration in the speed of price discovery around earnings announcements. When examining how this relation is affected by the magnitude of the earnings news, we find results that are consistent with findings in Table 5; the coefficient on the interaction between DNP and SUE is not different from zero. The evidence that intraperiod timeliness is insensitive to variation in DNP further supports the inference that reduced attention from retail investors does not lead to less efficient pricing around earnings announcements.

Taken together, the results in Tables 3, 4, 5, and 6 paint a nuanced but compelling picture of investor attention and its relation to pricing efficiency. Our results indicate that unexpected distractions are associated with reduced attention but only among retail investors. Unexpected distractions do not appear to be associated with reduced attention from institutional investors. Moreover, equity prices continue to promptly reflect earnings information, despite these distractions. These findings highlight the relative roles of retail and institutional investors and their trading in pricing efficiency around earnings announcements.

5 Additional analyses

5.1 Alternative measures of investor distraction

Research on investor inattention is conflicted about whether investors suffer from distraction and to what extent this distraction affects capital markets (DellaVigna and Pollet 2009; Hirshleifer et al. 2009; Melessa 2013; Michaely et al. 2016b; Drake et al. 2016). One reason for this ambiguity may be the lack of a clear identification strategy. Research has identified several potential measures of competing stimuli, such as Fridays, days with many earnings announcements, and days of popular sporting events. One challenge presented by this approach is that these measures of distraction are commonly foreseen and could be used by managers to strategically decide when to release information (Penman 1980; deHaan et al. 2015; Johnson and So 2018; Barth et al. 2021). We confirm the existence of strategic timing around these anticipatable competing stimuli measures in Table 2, which shows that the likelihood

[20] Untabulated statistics show that the sum of the coefficients on DNP and DNP×SUE is also indistinguishable from zero. Hence Table 5 provides no evidence of different announcement- or post-announcement-period price reactions to earnings announcements that coincide with unexpected distractions.

Table 6 Earnings timeliness

	Dependent variable:	
	IPT	
	(1)	(2)
SUE	0.005*	0.007
	(0.003)	(0.007)
DNP	−0.002	−0.001
	(0.003)	(0.007)
DNP × SUE		−0.0003
		(0.001)
Size	0.024**	0.024**
	(0.010)	(0.010)
BTM	−0.001	−0.001
	(0.006)	(0.006)
Analyst	0.001	0.001
	(0.004)	(0.004)
InstOwn	0.025***	0.025***
	(0.006)	(0.006)
Day of week FE	Yes	Yes
Year FE	Yes	Yes
Firm FE	Yes	Yes
Observations	104,875	104,875
Adjusted R^2	0.033	0.033

This table presents regression results from the estimation of Eqs. 2a and 2b using intraperiod timeliness (IPT) as the dependent variable. All independent variables are in decile rank form. Two-way firm and date cluster robust standard errors are in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%. All variable definitions appear in Appendix B

of firms reporting losses varies systematically with the level of anticipatable measures of competing stimuli. This challenge creates the possibility of a selection bias in studies that attempt to investigate the existence and consequences of inattention.

A key feature of our identification strategy is the independence of DNP, our measure of investor distraction, from corporate announcements. Unlike other measures of competing stimuli proposed elsewhere, DNP is not predictable. This prevents managers from timing their announcements in response to DNP levels. Consistent with this view, Table 2 shows that DNP is not significantly associated with the likelihood of a firm reporting a loss. Nonetheless, for completeness and comparison purposes, we replicate our primary tests including three commonly used measures of investor distraction. The first, an indicator variable that takes on the value of one if the announcement is made on Friday, is relatively straightforward. The second, the number of contemporaneous earnings announcements, NumEA, is based on the work of

Hirshleifer et al. (2009). Hirshleifer et al. (2009) propose a day-specific measure of potential distraction, NumEA, defined as the number of other earnings announcements made on a given day. The third measure, NCAA March Madness tournament days, NCAA, is based on the work of Drake et al. (2016). We augment Eqs. 1a and 1b with Friday, NumEA, and NCAA as additional control variables and re-estimate the two equations using ARVol and AIA as dependent variables. Table 7 presents summary statistics from this estimation.[21]

Table 7 reveals that the relation between Friday and ARVol is inconsistent with the idea of reduced attention on Fridays. In columns (1) and (2), where ARVol is the dependent variable, we observe that Friday has a positive and significant coefficient. This suggests that, all else equal, announcements on Fridays are accompanied by higher abnormal retail trading volume. These results are consistent with the results of deHaan et al. (2015) and Michaely et al. (2016a), who challenge the assertion that investor attention is lower on Fridays. However, in columns (3) and (4), where AIA is the dependent variable, we observe that Friday has a negative and significant coefficient. This suggests that, all else equal, Friday announcements are accompanied by lower abnormal institutional attention. This is somewhat consistent with findings of DellaVigna and Pollet (2009), who posit that earnings announcements on Fridays have weaker price reactions. Considering the magnitude of news in the earnings announcement does not alleviate this conflicting evidence; in both instances, the coefficient on the interaction of Friday and AbsSUE is indistinguishable from zero. Overall, there is mixed evidence regarding reduced investor attention on Fridays.

Column (1) of Table 7 reveals that days with more concurrent earnings announcements engender lower abnormal retail trading volume, as the coefficient on NumEA is significantly negative (coef. = −0.096). However, column (2) shows that the interaction between NumEA and AbsSUE is significantly positive (coef. = 0.148), suggesting that sufficiently large earnings surprises are associated with increased retail investor attention, even on high NumEA days. Columns (1) and (2) further reveal that there is no association between retail investor attention and NCAA tournament days, which is inconsistent with the notion that retail investors are distracted by the NCAA tournament. Moreover, the coefficient on the interaction between NCAA and AbsSUE is significantly positive (coef. = 2.403), indicating that earnings announcements on NCAA March Madness tournament days result in higher levels of institutional investor attention.

The findings presented in Table 7 show that our results attributed to the DNP measure of investor distraction are incremental to those previously documented using alternative measures of investor distraction. While DNP seems to have an unambiguously negative relation with retail trading volume, this is clearly not the case with Friday, NumEA, or NCAA. We further find that both DNP and NumEA describe types of distractions that do not affect institutional investors. In contrast, our results suggest that institutional investors do, ceteris paribus, exhibit less (more) attention

[21] We include Friday in all our previous estimations by inclusion of day-of-week fixed effects. The difference in Table 7 is that now we demonstrate the coefficient estimate on Friday and interact the Friday indicator with AbsSUE.

Table 7 Abnormal retail trading volume, Bloomberg searches, and alternative measures of distraction

	Dependent variable:			
	ARVol		AIA	
	(1)	2)	(3)	(4)
AbsSUE	0.127***	−0.159	0.058	0.573
	(0.042)	(0.233)	(0.106)	(0.524)
DNP	−0.010***	−0.010***	0.003	0.004
	(0.003)	(0.003)	(0.003)	(0.003)
Friday	0.049***	0.051***	−0.136***	−0.132***
	(0.019)	(0.019)	(0.035)	(0.035)
NumEA	−0.096***	−0.098***	0.001	0.001
	(0.006)	(0.007)	(0.011)	(0.011)
NCAA	0.030	0.038	0.130*	0.094
	(0.053)	(0.054)	(0.079)	(0.070)
DNP × AbsSUE		−0.038**		−0.040
		(0.016)		(0.037)
Friday × AbsSUE		−0.107		−0.347
		(0.097)		(0.273)
NumEA × AbsSUE		0.148***		−0.022
		(0.049)		(0.122)
NCAA × AbsSUE		−0.078		2.403***
		(0.456)		(0.518)
Controls	Yes	Yes	Yes	Yes
Day of week FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	52,416	52,416	14,487	14,487
Adjusted R^2	0.210	0.211	0.408	0.408

This table presents regression results from the estimation of Eqs. 1a and 1b using abnormal retail trading volume, (ARVol) and abnormal institutional attention (AIA) as dependent variables. In this estimation we also include Friday the number of concurrent earnings announcements (NumEA), and NCAA March Madness tournament days (NCAA) as alternative measures of distraction. All other controls from Eqs. 1a and 1b are included in the estimation but suppressed in the table for ease of exposition. Two-way firm and date cluster robust standard errors are in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%. All variable definitions appear in Appendix B

on Fridays (NCAA March Madness tournament days). Taken together, our findings using DNP as a measure of distraction provide stronger evidence for the adverse effect of distraction on retail investor attention to corporate announcements than can do studies that employ Fridays, NumEA, or NCAA. More broadly, the findings in Table 7 suggest that different types of investors exhibit different reactions to potential distractions.

Table 8 reveals that the relation between DNP and measures of price efficiency remains insignificant also after controlling for Friday, NumEA, and NCAA. Column (2) of Table 8 indicate that the coefficient on the interaction of Friday with SUE is insignificant. This suggests that the market response to earnings announcements made on Fridays is statistically indistinguishable from responses to announcements

Table 8 Announcement and post-announcement stock returns and alternative measures of distraction

	Dependent variable:			
	CAR[0, 1]		CAR[2, 60]	
	(1)	(2)	(3)	(4)
SUE	0.004***	0.004***	0.002***	0.002***
	(0.0001)	(0.0003)	(0.0002)	(0.001)
DNP	0.00001	−0.0001	0.0001	−0.00002
	(0.0001)	(0.0002)	(0.0002)	(0.001)
Friday	−0.001	−0.003*	0.002	0.005
	(0.001)	(0.002)	(0.003)	(0.005)
NumEA	0.0002	0.001***	−0.0003	0.00002
	0.0001)	(0.0002)	(0.0004)	(0.001)
NCAA	−0.003	0.018**	0.014	0.048
	(0.004)	(0.008)	(0.009)	(0.032)
DNP × SUE		0.00001		0.00002
		(0.00003)		(0.0001)
Friday × SUE		0.0004		−0.0005
		(0.0003)		(0.001)
NumEA × SUE		−0.0001***		−0.0001
		(0.00004)		(0.0001)
NCAA × SUE		−0.004***		−0.006
		(0.001)		(0.005)
Controls	Yes	Yes	Yes	Yes
Day of week FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	139,874	139,874	139,874	139,874
Adjusted R^2	0.029	0.030	0.024	0.024

This table presents regression results from the estimation of Eqs. 2a and 2b using announcement-period abnormal stock returns (CAR[0, 1]) and post-announcement-period abnormal stock returns (CAR[2, 60]) as dependent variables. All independent variables are in decile rank form. In this estimation we also include Friday, the number of concurrent earnings announcements (NumEA), and NCAA March Madness tournament days (NCAA) as alternative measures of distraction. All other controls from Eqs. 2a and 2b are included in the estimation but suppressed in the table for ease of exposition. Two-way firm and date cluster robust standard errors are in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%. All variable definitions appear in Appendix B

made on other weekdays. Our finding that earnings announcements made on Fridays are not associated with less efficient prices is consistent with the findings of Doyle and Magilke (2009) and Michaely et al. (2016b), who document the sensitivity of the Friday effect to the inclusion of firm fixed effects. Column (2) of Table 8 also shows that the coefficients on the interactions between NumEA and SUE and NCAA and SUE are significantly negative (coefs. = −0.0001 and −0.004). This finding is consistent with the results of Hirshleifer et al. (2009) and Drake et al. (2016), who document reduced price reactions to earnings announcements made on days with many contemporaneous earnings announcements and on NCAA March Madness tournament days.

Taken together, the results in Table 8 provide strong evidence that price reactions to earnings announcements are insensitive to unexpected distractions as measured by DNP, even after controlling for other common measures of investor distractions.[22]

5.2 Earnings announcements that coincide with management forecasts

Our main analyses use a sample of quarterly earnings announcements made by publicly traded firms on major stock exchanges in the United States from January 1, 1995, to December 31, 2015. In constructing this sample, we remove observations when the earnings announcement date coincides with a dividend announcement date to ensure that SUE accurately and completely measures the information provided on the earnings announcement date. However, some earnings announcements in our sample may still coincide with management forecasts, potentially generating measurement error in our use of SUE (Rogers and Buskirk 2013).

To confirm that our inferences are insensitive to the potential improper measurement of the information content of bundled earnings announcements, we re-estimate Eqs. 1b and 2b with additional controls for variables that capture the existence and the information content of management forecasts. In Eq. 1b, we include $EAMF_{i,t}$, an indicator variable that equals 1 if there is both an earnings announcement and management forecast by firm i on day t, and $MF\_Surp_{i,t}$, an indicator variable that equals 1 if firm i's management forecast on day t is classified as negative or positive via guidance codes of 1 or 2 in the IBES database. Table 9 presents summary regression statistics from the re-estimation of Eq. 1b for our four measures of investor attention with these additional controls. It reveals that the coefficients on EAMF and MF_Surp are significantly positive when either ATVol or ARVol is the dependent variable. This indicates higher overall trading volume and higher retail trading volume on days with bundled earnings announcements and supports the idea that EAMF and MF_Surp reflect the additional information disclosed in the bundled announcement. In addition, Table 9 indicates the coefficient estimates on the interaction of DNP and AbsSUE remain significant and negative in these specifications, suggesting that our inferences regarding reduced overall and retail trading volumes on days with high levels of unexpected distractions are insensitive to the presence of bundled

[22] Our evidence pertains to unexpected distractions as reflected in DNP. Different relations may exist between alternative measures of distraction and market pricing.

Table 9 Measures of volume and the bundling of management forecasts

	Dependent variable:			
	ATVol	Google	ARVol	AIA
	(1)	(2)	(3)	(4)
AbsSUE	0.381***	0.479	0.461***	0.321
	(0.088)	(0.324)	(0.148)	(0.274)
EAMF	0.066***	−0.024	0.039*	0.023
	(0.014)	(0.040)	(0.021)	(0.049)
MF_Surp	0.048***	0.025	0.060***	0.025
	(0.015)	(0.038)	(0.018)	(0.034)
DNP	−0.002	−0.008**	−0.010***	0.001
	(0.001)	(0.004)	(0.003)	(0.005)
DNP × AbsSUE	−0.030***	0.035	−0.035**	−0.031
	(0.009)	(0.036)	(0.016)	(0.034)
DNP × EAMF	−0.005***	0.003	−0.001	0.004
	(0.002)	(0.004)	(0.002)	(0.005)
DNP × MF_Surp	0.002	0.001	−0.0004	−0.001
	(0.002)	(0.004)	(0.002)	(0.004)
Controls	Yes	Yes	Yes	Yes
Day of week FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	139,874	49,059	52,416	14,487
Adjusted R^2	0.169	0.380	0.202	0.409

This table presents regression results from the estimation of Eqs. 1a and 1b using abnormal trading volume (ATVol), abnormal Google searches (Google), abnormal retail trading volume (ARVol), and abnormal institutional attention (AIA) as dependent variables. In this estimation we also include additional controls for variables that capture the existence and the information content of management forecasts: EAMF is an indicator variable that equals 1 if there is a bundled earnings announcement and management forecast and MF_Surp is an indicator variable that equals 1 if the management forecast is classified as negative or positive via guidance codes of 1 or 2 in the I\B\E\S database. All other controls from Eqs. 1a and 1b are included in the estimation but suppressed in the table for ease of exposition. Two-way firm and date cluster robust standard errors are in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%. All variable definitions appear in Appendix B

announcements. Our inferences regarding the lack of association between DNP and institutional investor attention also persist in this alternative specification.

Table 10 presents regression summary statistics from the estimation of Eq. 2b with our three measures of price efficiency as dependent variables and EAMF, MF_Surp, and MF_Pos as additional control variables. $MF\_Pos_{i,t}$ ($MF\_Neg_{i,t}$) is an indicator that equals 1 if firm i's day t management forecast is classified as positive (negative) in the IBES database. Table 10 shows that the coefficients on either DNP or the inter-

Table 10 Measures of price informativeness and the bundling of management forecasts

	Dependent variable:		
	CAR[0, 1]	CAR[2, 60]	IPT
	(1)	(2)	(3)
SUE	0.004***	0.002***	0.008
	(0.0002)	(0.001)	(0.007)
EAMF	0.001	−0.0003	0.139***
	(0.001)	(0.003)	(0.046)
MF_Pos	0.016***	0.004	0.070
	(0.002)	(0.004)	(0.071)
MF_Neg	−0.026***	0.007	0.140**
	(0.002)	(0.004)	(0.068)
DNP	−0.00004	0.0001	−0.001
	(0.0002)	(0.001)	(0.007)
DNP × SUE	0.00001	0.00001	−0.0005
	(0.00003)	(0.0001)	(0.001)
DNP × EAMF	−0.00001	−0.0001	0.0001
	(0.0002)	(0.0005)	(0.007)
DNP × MF_Pos	0.0003	−0.0002	0.019*
	(0.0003)	(0.001)	(0.011)
DNP × MF_Neg	−0.0003	−0.001	−0.001
	(0.0004)	(0.001)	(0.011)
Controls	Yes	Yes	Yes
Day of week FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Observations	139,874	139,874	104,875
Adjusted R^2	0.042	0.024	0.034

This table presents regression results from the estimation of Eqs. 2a and 2b using announcement-period abnormal stock returns (CAR[0, 1]) and post-announcement-period abnormal stock returns (CAR[2, 60]) as dependent variables. In this estimation we also include additional controls for variables that capture the existence and the information content of management forecasts: EAMF is an indicator variable that equals 1 if there is a bundled earnings announcement and management forecast and MF_Pos (MF_Neg) is an indicator variable that equals 1 if the management forecast is classified as positive (negative) via guidance codes of 1 or 2 in the I\B\E\S database. All other controls from Eqs. 2a and 2b are included in the estimation in decile rank form but suppressed in the table for ease of exposition. Two-way firm and date cluster robust standard errors are in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%. All variable definitions appear in Appendix B

actions between DNP and SUE remain indistinguishable from zero using each of our three measures of price efficiency. This suggests that our inferences regarding the unchanged price reaction to earnings news in the presence of unexpected distractions

are insensitive to whether earnings news is bundled with a management forecast. At the same time, however, note that the coefficient on the interaction between DNP and MF_Neg is weakly significantly negative when IPT is the dependent variable. This suggests stock prices more slowly reflect negative management forecasts that are made on days with high levels of unexpected distractions. Taken together, the evidence in Tables 9 and 10 bolsters our inferences that unexpected distractions as measured by DNP are associated with reduced investor trading and searching but are not associated with reduced price reactions to earnings announcements. Specifically, these tables illustrate that our inferences are robust to the presence of earnings announcements bundled with management forecasts.

6 Concluding remarks

We investigate how unexpected distractions affect investor reactions to earnings announcements. We hypothesize that investor attention to earnings announcements is weaker on days with high levels of unexpected distractions as measured by DNP, but that the muted attention is concentrated among retail investors and does not necessarily lead to lower price efficiency. We measure investor attention using four distinct metrics: overall trading volume, Google searches, retail trading volume, and Bloomberg searches. Using these metrics, we find evidence of investor inattention to earnings announcements but only among retail investors. We measure price efficiency using announcement stock returns, post-announcement stock returns, and earnings timeliness. In contrast to prior research that employs predictable measures of distraction, we find that the speed and magnitude of the price reactions to earnings announcements are unchanged in the presence of unexpected distractions. This finding persists even after considering the amount of information that arrives coincident with a firm's earnings announcement.

Our study makes three central contributions. Our first is showing the pervasive nature of strategic disclosure timing, which in turn necessitates measures of unexpected distraction, such as DNP, to enable valid inferences about investor attention to corporate announcements. The literature relies on measures such as Fridays, major sporting events, scheduled releases of key macroeconomic indicators, and days with many earnings announcements to capture potential distraction. A potential limitation shared by these measures is their predictability. This creates a significant empirical challenge along two dimensions when attempting to assess the level of investor attention to corporate announcements. First, to the extent that distraction is predictable, investors can strive to overcome the distraction. Additionally, managers can strategically time announcements to either exploit or avoid high-distraction periods. Our evidence suggests that managers indeed disclose systematically different information on Fridays, major sporting events, and days with many earnings announcements.

Given these empirical challenges, it is not surprising that debate continues in the literature regarding both the existence and the extent of investor inattention (DellaVigna and Pollet 2009), Michaely et al. (2016a, b). In contrast to these measures, DNP is largely unpredictable and unrelated to investors' valuation decisions. For example, we find no evidence of systematically different information disclosed on days with

high DNP. As such, it offers us the ability to examine investor attention in the absence of strategically timed announcements.

Our second contribution lies in our distinction between retail and institutional investors when examining investor inattention. In separately examining the behavior of these two groups of investors, we find that not all investors are equally distractible. This distinction also allows us to study the relative roles of retail and institutional traders in price discovery, which marks a third contribution of our study. We provide robust evidence that pricing efficiency is unaffected by limited retail attention due to unexpected distractions. These findings mark an important development in the investor inattention literature, which has previously overlooked the distinction between retail and institutional traders and thus concluded that limited investor attention consistently leads to less efficient market prices. Our findings reveal that some types of distractions can indeed reduce investor attention without disturbing the process by which information is impounded into equity prices.

Appendix A: Daily news pressure index (DNP)

The daily news pressure (DNP) index captures the availability of news, measured as the median number of minutes across the main TV news broadcasts (ABC, CBS, and NBC) devoted to the first three news segments in a given day. To compile that, we obtain from the Vanderbilt Television News Archives a detailed list of all news segments broadcast by the three networks on their evening news program each day. We then count, for each network, the number of seconds spent on the first three segments (excluding commercials, anchor segments, and program introductions). The daily median number of seconds is then divided by 60 to derive a daily news pressure index. Because the duration of each program is 30 minutes, the news pressure index takes a value between (close to) 0 and 30.

To further illustrate the data underlying the calculation of DNP, Table 11 provides the detailed breakdown of evening news coverage on the three main news networks on August 2, 2007. The top three news segments for broadcast are in bold. The table reveals that ABC spent 13:10 minutes on "Minneapolis Bridge Collapse," 2:50 minutes on "Infrastructure," and 0:30 minutes on "Toy Recall" for a total of 990 seconds on its first three news segments. CBS spent 12:30 minutes, 2:50 minutes, and 1:30 minutes (total of 1,010 seconds) on its first three news segments, and NBC spent 13:10 minutes, 2:40 minutes, and 0:30 minutes (total of 980 seconds). Across the three networks, the median number of seconds spent on the first three news segments on August 2, 2007, was 990 seconds, or 16.5 minutes.

In contrast, on August 8, 2007, ABC spent 300 seconds on "Heat Wave," "Global Weather," and "Mine Cave-in." CBS spent 220 seconds on "Mine Cave-in," "Minneapolis Bridge Collapse," and "Wild Weather." And NBC spent 640 seconds on "Heat Wave," "Shuttle Endeavour Liftoff," and "Utah Mine Collapse." Thus, on August 8, 2007, the median number of seconds spent on the first three news segments across the three networks is 300 seconds or 5.0 minutes. We interpret this as an indication that the news pressure on August 2, 2007, is greater than on August 8, 2007.

Table 11 Construction of DNP: example from August 2, 2007

No.	Date	Headline	Network	Begin	Length
1	8/2/07	Preview/Introduction Charles Gibson (Minneapolis)	ABC	05:30:00pm	0:50
2	8/2/07	**Minneapolis, Minnesota/Bridge Collapse/The Day After**	ABC	05:30:50pm	13:10
3	8/2/07	Upcoming Items (Minneapolis: Charles Gibson)	ABC	05:44:00pm	0:40
4	8/2/07	(Commercial: VESIcare; Caduet; Florida orange juice.)	ABC	05:44:40pm	2:30
5	8/2/07	**Infrastructure**	ABC	05:47:10pm	2:50
6	8/2/07	Upcoming Items (Minneapolis: Charles Gibson)	ABC	05:50:00pm	0:10
7	8/2/07	(Commercial: Zetia; Gas-X; Benefiber; Centrum; Detrol)	ABC	05:50:00pm	3:00
8	8/2/07	**Toy Recall**	ABC	05:53:00pm	0:30
9	8/2/07	Stock Market Report (Minneapolis: Charles Gibson)	ABC	05:53:30pm	0:10
10	8/2/07	Arctic Grab	ABC	05:53:40pm	0:20
11	8/2/07	Upcoming Items (Minneapolis: Charles Gibson)	ABC	05:54:00pm	0:20
12	8/2/07	(Commercial: Advair; Red Lobster; Serenity; Plavix)	ABC	05:54:20pm	3:00
13	8/2/07	Minneapolis, Minnesota/Bridge Collapse/Book	ABC	05:57:20pm	1:00
14	8/2/07	Good Night	ABC	05:58:20pm	0:10
1	8/2/07	Preview/Introduction Katie Couric (Minneapolis)	CBS	05:30:00pm	0:50
2	8/2/07	**Minneapolis, Minnesota/Bridge Collapse/The Day After**	CBS	05:30:50pm	12:30
3	8/2/07	Upcoming Items (Minneapolis: Katie Couric)	CBS	05:43:20pm	0:20
4	8/2/07	(Commercial: Hyundai; Dannon; Prilosec; Oral-B.)	CBS	05:43:40pm	2:30
5	8/2/07	**Minneapolis, Minnesota/Bridge Collapse/Infrastructure**	CBS	05:46:10pm	2:50
6	8/2/07	Upcoming Items (Minneapolis: Katie Couric)	CBS	05:49:00pm	0:10
7	8/2/07	(Commercial: Serenity; Lanacane; Caduet; Advair)	CBS	05:49:10pm	2:30
8	8/2/07	**Toy Recall**	CBS	05:51:40pm	1:30
9	8/2/07	Stock Market Report (Minneapolis: Katie Couric)	CBS	05:53:10pm	0:30
10	8/2/07	(Commercial: CBS Evening News; Beano; Poligrip)	CBS	05:53:40pm	2:50
11	8/2/07	Minneapolis, Minnesota/Bridge Collapse	CBS	05:56:30pm	2:20
12	8/2/07	Good Night	CBS	05:58:50pm	0:10
1	8/2/07	Preview/Introduction Brian Williams (Minneapolis)	NBC	05:30:00pm	0:30
2	8/2/07	**Minneapolis / Bridge Collapse / The Day After**	NBC	05:30:30pm	13:10
3	8/2/07	Upcoming Items (Minneapolis: Brian Williams).	NBC	05:43:40pm	0:30
4	8/2/07	(Commercial: Bayer; Zetia; Hyundai)	NBC	05:44:10pm	2:20
5	8/2/07	**Minneapolis / Bridge Collapse / Infrastructure**	NBC	05:46:30pm	2:40
6	8/2/07	Upcoming Items (Minneapolis: Brian Williams)	NBC	05:49:10pm	0:30
7	8/2/07	(Commercial: Purina; Imodium; Oral-B; Flomax.)	NBC	05:49:40pm	2:30
8	8/2/07	**Iraq / Gates**	NBC	05:52:10pm	0:30
9	8/2/07	Toy Recall / China / Tainted Products	NBC	05:52:40pm	1:50
10	8/2/07	Stock Market Report (Minneapolis: Brian Williams)	NBC	05:54:30pm	0:10
11	8/2/07	Upcoming Items (Minneapolis: Brian Williams)	NBC	05:54:40pm	0:10
12	8/2/07	(Commercial: Avodart; Serenity; Red Lobster; Viagra)	NBC	05:54:50pm	2:50
13	8/2/07	”Minneapolis, Minnesota / Bridge Collapse ”	NBC	05:57:40pm	0:50
14	8/2/07	Good Night	NBC	05:58:30pm	0:10

Appendix B: Variable definitions

Variable	Description
$SUE_{i,t}$	Standardized unexpected earnings of firm i for quarter t. Measured as the difference between net income of quarter t and net income from four quarters ago, scaled by a firm i's stock price at the end of quarter t
DNP_t	Average daily news pressure across days t and $t+1$
$ATVol_{i,t}$	Log of 1+ the ratio of average overall share turnover for firm i across days [0, 1] to the average overall daily turnover for firm i over days [-54, -5] minus an analogous amount for all firms traded on major stock exchanges in the United States, relative to firm i's earnings announcement day t
$Google_{i,t}$	Log of the rank of Google search volume index (SVI) for firm i on days [0, 1] relative to the average SVI over days [-30, -1] of a firm's earnings announcement day t
$ARVol_{i,t}$	Log of 1 + the ratio of average retail share volume for firm i across days [0, 1] to the average retail share volume for firm i over days [-54, -5] minus an analogous amount for all firms traded on major stock exchanges in the United States, relative to firm i's earnings announcement day t
$AIA_{i,t}$	Abnormal institutional attention from Bloomberg terminals, estimated following the procedure outlined by Ben-Rephael et al. (2017)
$CAR[a, b]_{i,t}$	Cumulative size and book-to-market-adjusted stock return for firm i from day a to day b relative to earnings announcement day t
$IPT_{i,t}$	Intraperiod timeliness of returns of firm i for quarter t. Defined as $\sum_{j=0}^{4} \frac{CAR[0,j]}{CAR[0,5]} + 0.5$
$Size_{i,t}$	Log of market value of equity for firm i on day t
$BTM_{i,t}$	Ratio of book value of equity to market value of equity for firm i on day t
$Analyst_{i,t}$	Log of 1 + the number of analysts providing an earnings forecast for firm i during month t
$InstOwn_{i,t}$	Percentage of firm i's shares owned by institutions at the most recent quarter-end, relative to day t
$Friday_t$	Indicator equalling 1 if day t is a Friday and 0 otherwise
$NCAA_t$	Indicator equalling 1 if day t is an NCAA March Madness tournament day as defined by Drake et al. (2016) and 0 otherwise
$NumEA_t$	Log of the number of earnings announcements made on day t
$EAMF_{i,t}$	Indicator equalling 1 if day t of firm i's earnings announcement day coincides with a management forecast day
$MF\_Surp_{i,t}$	Indicator equalling 1 if firm i's management forecast is classified as negative or positive (i.e., guidance codes of 1 or 2 in the IBES database)
$MF\_Pos_{i,t}$	Indicator equalling 1 if firm i's management forecast is classified as positive (i.e., a guidance code of 2 in the IBES database)
$MF\_Neg_{i,t}$	Indicator equalling 1 if firm i's management forecast is classified as negative (i.e., a guidance code of 1 in the IBES database)

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