

## **Limited Attention**

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### **Abstract**

Investor attention is a limited resource. This chapter discusses the literature on investor limited attention and its effects on capital markets. Theoretical and empirical studies find that when some investors are inattentive, the immediate market reaction to news is incomplete and the price exhibits a post-announcement drift. The underreaction is stronger when investor attention is distracted by competing stimuli, when the information is less salient or harder to process, and when investors are less sophisticated. While retail investors suffer more from limited attention, the effects of limited attention are also significant for sophisticated market participants, such as financial analysts, institutional investors, market makers, and financial data providers. Firms incorporate investor limited attention by choosing disclosure timing and format to highlight good news and reduce attention to unfavorable information. Collectively, the reviewed studies indicate that investor limited attention has important and far-reaching effects on capital markets.

### **Introduction**

In the current world of the Big Data revolution where a vast amount of information is available to investors, attention is a scarce resource. The time, effort, and skill required to identify, acquire, and process all relevant information for decision making can be substantial. Consider for example the large volume of information available about a single firm from mandated financial statements and voluntary disclosures produced by the firm itself, reports generated by infomediaries such as analysts, news articles by business journalists, message or opinion postings

on social media platforms by investors and other stakeholders, and relevant data publicly available on the Internet or curated from proprietary sources about firm activities.

Even reading a single document, such as this chapter on limited attention, requires a certain amount of time and attention. Moreover, investors need to evaluate and compare information for many other firms before they can make informed investment decisions. Time is also of the essence. During a busy earnings announcement season, hundreds of firms often announce their earnings on the same day. With the proliferation of information and attention being a finite resource, attention becomes the bottleneck. To understand how capital markets function when there is limited attention, we need to know how investors, managers, and other stakeholders make decisions when faced with limited attention.

The traditional theory assumes that information processing costs are negligible, and all publicly available information is incorporated into stock prices immediately and fully. In contrast, limited attention theory posits that investors have finite attention and processing power and that this resource constraint is binding. Investors cannot fully attend to all public news. Instead, only a subset of investors attend to any specific piece of information at any given time, while the attention of other investors is consumed by other news. In this market with limited investor attention, the key prediction is that the stock price would not be able to fully incorporate all available information.

In this chapter, we first provide a simple example of a theory model to illustrate testable predictions for how limited attention effects have consequences for the capital markets. Then, we review empirical studies examining a wide set of predictions from limited attention theory. Limited attention theory offers a unifying framework that can explain a broad set of empirical findings, including misreaction to public information, post-earnings announcement drift, effects of news salience, and managerial choices regarding the format and timing of disclosures.

In the next section, we discuss a simple limited attention model and its predictions about investor immediate and delayed reaction to firms' earnings announcements. The model illustrates how investor reaction to a firm's announcement depends on the degree of investor attention and the amount of additional relevant information disclosed by the firm in the announcement. Next, we review empirical evidence on the factors that influence investor attention and investor reaction to earnings news. We discuss the effects of distraction due to competing stimuli, investor sophistication, news salience and information processing ease, allocation of attention to competing tasks, information intermediaries, and disclosure timing. We turn next to examining investor

limited attention on managerial decisions. We discuss studies on how investor limited attention influences firms' strategic choices regarding disclosure timing and qualitative disclosure attributes. The final section summarizes and concludes our discussion.

### **Limited Attention Theory, Market Reaction to News, and Return Predictability**

When some investors have limited attention, these inattentive investors attend to a subset of publicly available information. The equilibrium price reflects the weighted average of the expectations of attentive and inattentive investors. As a result, the price exhibits underreaction to the public news at the announcement date and continues to drift in the direction of the news when inattentive investors catch up with the news. In the context of an earnings news announcement, this price pattern is the post-earnings-announcement drift (PEAD). Bernard and Thomas (1989, 1990) document that stock prices continue to drift upward (downward) following earnings announcements when the quarterly earnings news are above (below) expectations. This price pattern is one of the most famous and robust anomalies and has been widely studied. Fink (2020) provides a survey review of the various characteristics of PEAD documented in the literature. PEAD is a global phenomenon; it is observed in both developed and emerging financial markets. PEAD is stronger for small firms, firms with lower analyst following, and firms with lower institutional ownership. PEAD is not subsumed by other anomalies such as price momentum, accruals anomaly, or value-growth anomaly.

In this section, we present a simple limited attention model adapted from Hirshleifer and Teoh (2003), Hirshleifer, Lim, and Teoh (2011), and Li, Nekrasov, and Teoh (2020). Assume that a fraction  $1 - \gamma$  of investors are fully attentive to public information, and the other fraction  $\gamma$  of investors are inattentive. Attentive investors acquire and fully process the disclosed information, whereas inattentive investors are either unaware of the disclosure or do not process the content of the disclosure. In other words, attentive investors update as rational Bayesians using the public information, whereas inattentive investors do not update at all. We can think of attention in the investor population,  $1 - \gamma$ , as increasing with information salience, processing ease, and investor sophistication, and decreasing with the distraction due to competing events.

There is a single risky security (stock) and a risk-free asset (cash) in the market. Investors can trade assets at each of dates 0, 1, 2, and 3, and consume at terminal date 3. Date 0 is before the earnings announcement, and the stock price at that date is denoted as  $P_0$ . At date 1, the firm

announces earnings, which provides investors with public information about the terminal value of the stock. At date 2, the firm's filing date of financial statements with the authorities, investors may receive further information about the terminal value of the stock. At date 3, investors receive the terminal payoff of the stock,  $P_3$ , and consume. Following Hirshleifer and Teoh (2003), we assume that the stock is in zero net supply, which implies that there is no risk premium. At date 1, solving for optimal investor trading positions in the stock as a function of price  $P_1$ , then imposing the market clearing condition that the sum of the trading positions is zero, we can solve for the equilibrium price. This is a weighted average of the expectations of attentive and inattentive investors,

$$P_1 = fE^I[P_3|\Phi] + (1 - f)E^A[P_3|\Phi], \quad (1)$$

where  $\Phi$  denotes the information available at date 1, superscripts  $A$  and  $I$  represent the beliefs of attentive and inattentive investors, respectively. The parameter  $f$  is an increasing function of the fraction of inattentive investors,  $\gamma$ :

$$f = \frac{\frac{\gamma}{\text{var}^I(P_3)}}{\frac{\gamma}{\text{var}^I(P_3)} + \frac{1 - \gamma}{\text{var}^A(P_3)}}, \quad (2)$$

where  $\text{var}^I(P_3)$  and  $\text{var}^A(P_3)$  are the variances of future firm value unconditionally or conditional upon public signals, respectively.

Now, consider two alternative information disclosure regimes. In the timely disclosure (TD) regime, at date 1 the firm discloses both earnings  $e$  and a financial statement item  $\lambda$ , which together comprise the date 1 information set  $\Phi$ . In the delayed disclosure (DD) regime, the firm delays the disclosure of the financial statement item to date 2, and  $\Phi$  consists of only earnings  $e$ . Attentive investors incorporate the additional information  $\lambda$  disclosed at date 1 into their expectations, whereas inattentive investors ignore the disclosed information. The price at date 1 in the TD regime is:

$$P_1(e, \lambda) = f^{e, \lambda}E[P_3] + (1 - f^{e, \lambda})E[P_3|e, \lambda], \quad (3)$$

where the expectation of inattentive investors is the prior expectation,  $E^I[P_3|e, \lambda] = E[P_3]$ , and similarly inattentive variances are equal to prior variances  $\text{var}^I(P_3) = \text{var}(P_3)$ . In contrast, the expectation of attentive investors is the fully rational Bayesian update conditional on all available information,  $E^A[P_3|e, \lambda] = E[P_3|e, \lambda]$ , and variances are conditional upon all available

information as well. By (3), the effective weight for the beliefs of inattentive investors in the TD regime is:

$$f^{e,\lambda} = \frac{\frac{\gamma}{\text{var}(P_3)}}{\frac{\gamma}{\text{var}(P_3)} + \frac{1-\gamma}{\text{var}^A(P_3|e,\lambda)}} \quad (4)$$

In the DD regime, where only earnings  $e$  is disclosed, the price at date 1 is:

$$P_1(e) = f^e E[P_3] + (1 - f^e) E[P_3|e]. \quad (5)$$

Similar to the TD regime, the expectation of inattentive investors is the prior expectation,  $E^I[P_3|e] = E[P_3]$ , and inattentive variances are equal to prior variances; and the expectation of attentive investors is the fully rational Bayesian update conditional on the available earning information,  $E^A[P_3|e] = E[P_3|e]$ , and variances are conditional upon  $e$  as well. The effective weight for the beliefs of inattentive investors in the DD regime is:

$$f^e = \frac{\frac{\gamma}{\text{var}(P_3)}}{\frac{\gamma}{\text{var}(P_3)} + \frac{1-\gamma}{\text{var}^A(P_3|e)}} \quad (6)$$

Since variance  $\text{var}^A(P_3|e) > \text{var}^A(P_3|e,\lambda)$ , the effective weight  $f^{e,\lambda}$  on the beliefs of inattentive investors is lower in the TD regime than the weight  $f^e$  in the DD regime.

Using (3) or (5), the immediate reaction to the earnings news as reflected in the earnings response coefficient (ERC) is obtained by differentiating the change in the stock price from date 0 to date 1 with respect to the earnings news  $e - \bar{e}$  at date 1. The ERC in the two cases is as follows.

TD regime:

$$ERC_{TD} = (1 - f^{e,\lambda})\beta_{P_3,e} \quad (7)$$

DD regime:

$$ERC_{DD} = (1 - f^e)\beta_{P_3,e} \quad (8)$$

The term  $\beta_{P_3,e}$  is the ERC if the fraction of inattentive investors were zero (i.e.,  $\gamma, f^{e,\lambda}$ , and  $f^e$  were all zero). However, when inattentive investors are present, the fraction of inattentive investors  $f^{e,\lambda}$  and  $f^e$  in the TD and DD regimes respectively are positive. Thus, Equations (7) and (8) show that in both the TD and DD regimes, the ERC decreases with the proportion of inattentive investors ( $f^{e,\lambda}$  or  $f^e$ ). Thus, we have the following observation.

**Observation 1a:** *The immediate market reaction to earnings news is lower when the proportion of inattentive investors is high.*

Furthermore, as explained above,  $f^{e,\lambda} < f^e$ , so comparing Equations (7) and (8), the ERC is lower in the DD regime when the financial statement item is not disclosed at the same time that the earnings news is disclosed, date 1. Thus, we have the following observation.

**Observation 1b:** *The immediate market reaction to earnings news is lower when financial statement disclosure is delayed (DD regime) than when it is not (TD regime).*

Turning to post-earnings announcement drift (PEAD), the delayed market reaction to earnings news is obtained in a similar way by differentiating the change in the stock price from date 1 to date 3 with respect to with respect to the earnings news  $e - \bar{e}$  at date 1. The PEAD coefficients in the two cases are as follows.

TD regime:

$$PEAD - C_{TD} = f^{e,\lambda} \beta_{P_3,e} \quad (9)$$

DD regime:

$$PEAD - C_{DD} = f^e \beta_{P_3,e} \quad (10)$$

Equations (9) and (10) show that (1) the PEAD increases with the proportion of inattentive investors (i.e.,  $f^{e,\lambda}$  or  $f^e$ ) in both TD and DD regimes, and (2) the PEAD is higher in the DD regime than in the TD regime (since  $f^e > f^{e,\lambda}$ ). Thus, we have the following observations.

**Observation 2a:** *The post-earnings announcement drift is greater when the proportion of inattentive investors is high.*

**Observation 2b:** *The post-earnings announcement drift is greater when financial statement disclosure is delayed (DD regime) than when it is not (TD regime).*

Finally, we consider the price reaction at the filing date, date 2. For brevity, we limit our discussion to a summary of the key elements of this analysis. Because there is a fixed cost of attending to information and because the filing is later than the earnings announcement, the proportion of inattentive investors at the filing date,  $f'$ , is lower than that at the earnings announcement date,  $f$ . Therefore, the effective weight in the market price at date 2 on investors who pay attention to both the earnings news and the financial statement item is lower in the DD regime, where the financial statement is disclosed at a time when investor attention is low. As a result, the total price reaction to earnings news from date 0 to date 2 is lower in the DD regime

than in the TD regime. The price correction occurs only at a late date when investors realize the terminal payoff. Thus, we have the following observations.

**Observation 3a:** *The sum of the earnings response coefficients at the earnings announcement date and at the filing date is lower when financial statement disclosure is delayed (DD regime) than when it is not (TD regime).*

**Observation 3b:** *The price drift after the filing date is higher when financial statement disclosure is delayed (DD regime) than when it is not (TD regime).*

The above framework comparing TD and DD regimes can be reinterpreted to analyze the situation where observant investors notice both pieces of information, earnings  $e$  and additional information  $\lambda$ , versus inattentive investors who notice only earnings  $e$ . The framework can also be adapted to obtain testable predictions about the effects of limited attention on stock market reactions to news in wide range of other situations. For example, as mentioned earlier, the attention variable  $(1 - \gamma)$  can be used to represent the salience of the information disclosure, or the ease of processing of the information item to study capital market effects of different presentation formats of disclosures. Higher salience or easier processing translates to a higher fraction of investors that are attentive, and the limited attention model predicts stronger immediate price response to the more salient presentation of news and a consequent more muted longer-window price response or drift. The parameter  $\gamma$  can also be used to proxy for investor characteristics such as financial sophistication, or it can proxy for situational characteristics such as the degree of distraction due to contemporaneous events that compete for investor attention. A key advantage of this limited attention framework is its adaptability to accommodate a wide set of realistic disclosure characteristics and provide a rich set of testable predictions to study many disclosure related issues.

## **Empirical Evidence**

### ***Investor Inattention Due to Competing Stimuli***

Attention is a limited cognitive resource. When multiple stimuli compete for investor attention, attention to one task requires a substitution of attention from other tasks (Kahneman and Tversky, 1973). Therefore, on days with higher investor distraction, limited attention model predicts a more muted immediate price response and consequently a stronger price drift response in the subsequent period. This prediction has been tested in various settings or contexts. Hirshleifer, Lim, and Teoh (2009) find that when there is a large number of earnings announcements on the

same day, investor attention to a focal firm's earnings announcement can be distracted by other firm announcements, and irrelevant stimuli such as industry-unrelated news. They find evidence that the distraction leads to a weaker investor reaction to the earnings news and a stronger post-earnings announcement drift. Interestingly, they find that when the competing firms announcing on the same day belong to unrelated industries, investor distraction effects are stronger. This is intuitive as a concentration of peer firms announcing on the same day can actually draw attention to the industry and therefore lead to a higher focus of attention to the announcing firms within the same industry.

DellaVigna and Pollet (2009) propose that investor attention is lower on Friday as the upcoming weekend distracts investors from the task of stock valuation in response to earnings news made on Fridays. They find muted market response to Friday earnings announcements and a larger drift in the subsequent days. Because the choice of the day in the week to announce earnings is endogenous, they expect the total price reaction over the quarter to the earnings news may vary. Therefore, they test the limited attention prediction for the price reaction as the ratio of the immediate price response to the drift response (or the total quarter return response). In the context of merger announcements, Louis and Sun (2010) find muted market reaction to Friday stock swap announcements, suggesting investor inattention is present even in the context of one of the largest corporate events. Israeli, Kasznik, and Sridharan (2021) use a daily news pressure variable to measure the availability of newsworthy material on a given day to proxy for potential investor distraction. They find that investor attention to earnings announcements is weaker on days with high levels of unexpected distractions as measured by the daily news pressure.

Investor attention can also be influenced by non-information events. For instance, Drake, Gee, and Thornock (2016) find that the NCAA basketball tournament during March each year diverts millions of investors' attention away from earnings news, and therefore the price reaction to earnings news released during NCAA basketball tournament is muted. Brown, Elliot, Wermers, and White (2022) use the exogenous outages of the Blackberry Internet Service (BIS) and study whether mobile internet distract investors from participating in financial markets. Consistent with the distraction hypothesis, they find a significant increase in trading volume and trading frequency when BIS unexpectedly goes offline. On the other hand, Madsen and Niessner (2019) study how investors respond to attention-grabbing events with little public information, specifically firms' print advertisements. They find that print ads, especially in business publications, trigger



temporary spikes in trading volumes. The evidence is consistent with the notion that in the presence of limited attention, advertisements remind potential investors about the company and result in increased search and trading for its stock.

### ***Limited Attention of Analysts, Institutional Investors, and Loan Officers***

The evidence of past studies also show that limited attention effects extend also to sophisticated financial analysts. Several accounting studies examine analysts' use of financial information assuming analyst limited attention. For example, Koester, Lundholm, and Soliman (2016) examine whether firms use the announcement of extreme positive earnings surprises to attract analysts' attention. They indeed find an intuitive result that extreme positive earnings surprises are more salient to analysts and therefore draw more of their attention. Choi and Gupta-Mukherjee (2022) find that analysts with larger workloads and less resources are more likely to rely on industry- than firm-specific information. They find that this reliance on industry information is associated with lower forecast accuracy.

Recent studies provide direct evidence supporting the distracting effect among sell-side analysts. deHaan, Madsen, and Piotroski (2017) find that analysts are slower to respond to an earnings announcement when they experience lower attention due to inclement weather. Driskill, Kirk, and Tucker (2020) provide compelling evidence that even information specialists such as financial analysts are subject to limited attention. Specifically, they find that analysts are less likely to (1) issue timely earnings forecasts, (2) ask questions during the earnings conference call, and (3) slower in providing stock recommendations for a firm when there is another firm in their coverage portfolio that announces earnings on the same day. Du (2022) and Li and Wang (2021) study the influence of childcare responsibilities on analyst forecast outcomes, especially for female analysts. Using the shocks of school closures caused by the COVID-19 pandemic, the studies find that female analysts are less likely to issue timely forecasts and their forecasts become less accurate after school closures compared to their male counterparts, consistent with the notion that female analysts are distracted by their childcare responsibilities due to school closures.

Large institutional shareholders are also bounded by the amount of attention cognitive resource. Based on the findings from a large-scale survey, the Investor Responsibility Research Center Institute (IRRC 2011) expresses concern about the influence of limited institutional investor attention on their monitoring activity: "three-fourths of institutions report that time is the most common impediment to engagement [with corporations], while staffing considerations rank

second.” Kempf, Manconi, and Spalt (2017) identify “distracted” shareholders by exploiting exogenous shock to unrelated parts of the institutional shareholders’ portfolios. They find that firms with “distracted” shareholders are more likely to engage in diversifying and value-destroying acquisitions. The result is consistent with the concern that managers take advantage of the looser monitoring when institutional shareholders are distracted by events of other firms in their portfolios. We will discuss managerial decisions when investors have limited attention in a later section.

Campbell, Loumioti, and Wittenberg-Moerman (2019) study the influence of attention on decision making for loan officers. They find that lending decisions based on soft information (e.g., qualitative and hard-to-verify information) lead to worse quality loans when loan officers are distracted and fail to accurately interpret and reflect on soft information.

Investor attention may also be affected by the geographic location. Dyer (2021) study the demand for public information by local versus non-local investors. He finds that the same investor chooses to acquire more public information for local firms than for non-local firms. But the local preference in information acquisition tends to decrease as proxies for information processing capacity increases. These findings are consistent with investors being more attentive to local investments, which diverts attention away from non-local investments.

### ***Investor Sophistication***

Sophisticated investors such as sell-side analysts (Driskill, Kirk, and Tucker, 2020; Chiu, Lourie, Nekrasov, and Teoh, 2021), and institutional shareholders (Kempf, Manconi, and Spalt, 2017) exhibit limited attention. However, retail investors are more subject to attention and time constraint in processing financial information. The accounting and finance literature provide a large body of evidence that the effects of limited attention are more pronounced for less sophisticated or less experienced investors and analysts. For example, Bartov, Radhakrishnan, Krinsky (2000) use institutional ownership as a proxy for investor sophistication and find that post-earnings announcement drift is concentrated among firms with a high percentage of unsophisticated investors.

In responding to the Securities and Exchange Commission (SEC)’s and Financial Accounting Standard Board (FASB)’s calls for clear and concise disclosures and for improving the readability of financial disclosures to individual investors (SEC, 2007; FASB, 2010), Lawrence (2013) studies whether retail investors are more subject to attention and time constraints when

processing complicated financial disclosures. He finds that retail investors have lower relative information disadvantages and invest more in firms with clear and concise financial disclosures. The evidence highlights the importance of disclosure clarity, which directly impacts the amount of information that can be absorbed by investors with limited attention.

In recent years, companies and the capital market has started to adopt new technologies to help investors, especially retail investors, suffer less from limited attention to news events. For example, Blankespoor, deHaan, and Zhu (2018) study the implementation of “robo-journalism” technology by Associated Press and how it influences investor attention to the earnings news. Robo-journalism writes articles about firm’s earnings press release by synthesizing information from firm’s press release, analyst report, and stock information, and then distributes the articles over national and local outlets. These articles only contain public information. More importantly, it provides a concise synthesis of salient information that are likely to attract investor attention. As a result, the increasing awareness to earnings news due to the “robo-journalism” technology is associated with increasing investor trading activities, especially by retail investors. Moss (2022) examines how retail brokerages’ use of push notifications impact retail investor attention and trading behavior. He finds that push notifications have a significant impact on the amount of retail investor trading, increasing the number of retail trades by approximately 25% in the minutes following a notification. The evidence is consistent with the idea that investors are more attentive to the stocks that get “pushed” to the front of their minds and so they are more likely to act by trading these stocks.

Early studies in accounting and finance rely on indirect measures of attention, for example extreme returns (Barber and Odean, 2008), and trading volume (Barber and Odean, 2008; Hou, Peng, and Xiong, 2009). However, limited attention encompasses not just mere awareness of the information but extends also to the acquisition and processing costs that can prevent investors from incorporating information into trading decisions (Blankespoor, deHaan, Wertz, and Zhu, 2019). Recent studies construct novel measures that can directly capture investor attention. Da, Engelberg, and Gao (2011) use Google search activity as a proxy for retail investor attention. They argue that internet users commonly use search engines to collect information and Google accounts for a majority of search queries in the United States. More importantly, if one searches for a stock in Google, then that person is undoubtedly paying attention to the stock. The authors find that firms

with an increase in Google search frequency experience more retail trading, higher short-term stock price and long-term price reversal.

Relatedly, Ben-Rephael, Da, and Israelsen (2017) measure institutional investor attention using searching and reading activities on Bloomberg terminals. They find that their institutional investor attention measure is significantly different from other investor attention measures and highly correlated with institutional trading behavior. They also compare retail attention proxied by Google search activities and institutional investor attention from Bloomberg searches and find that institutional attention responds in a more timely manner to major news events.

Lu, Ray, and Teo (2016) examine the limited attention among another type of sophisticated investors—hedge fund managers. They find that hedge fund managers' marriage and divorce activities are associated with lower fund alpha in both the short-term and long-term, consistent with the distraction effect of marital events.

### ***News Salience and Information Processing Ease***

People are more likely to process information that is more salient and easier to process (Fiske and Taylor 2016). Early studies use the placement, categorization, and labeling of information in financial statements to measure the salience of the information and to examine how salience affects investor incorporation of the information into stock prices. One important finding is that investors put higher weights on information presented in the financial statements compared to information disclosed in the footnotes (Aboody, 1996; Ahmed, Kilic, and Lobo, 2006; Amir, 1993). Similarly, Files, Swanson, and Tse (2009) provide evidence that the market reaction to restatement announcements is stronger when the restatement is disclosed in the headline of the press release, a location of high salience, than when the restatement is disclosed in the body or footnote of the press release.

Studies in the finance and accounting literature provide evidence that the salience of earnings news increases with broader dissemination via information intermediaries such as business press and social media. Klibanoff, Lamont, and Wizman (1998) find that the price reaction to close-end country fund is stronger when the country-specific news appeared on the front page of *New York Times*, consistent with the notion that media coverage increases the salience of country-related information and then triggers investor trading. Kimbrough (2005) find that the initiation of conference calls is associated with reduction in analyst forecast errors, consistent with the notion that conference calls provide managers with the opportunity to highlight and direct

investor attention to the key earnings metrics that otherwise may be ignored. Drake, Guest, and Twedt (2015) provide evidence that disseminating accounting information via business press increases the number of investors who are aware of the news and reduces the mispricing of accounting information. Fang and Peress (2009) find that firms with no media coverage earn higher stock returns than firms with high media coverage, which is consistent with the notion that media coverage increases investor awareness about stocks.

In a field experiment, Lawrence, Ryans, Sun, and Laptev (2018) promote earnings announcements to a subset of Yahoo Finance users for a randomly selected firms, and find that promoted firms experience stronger market reaction to earnings news. This finding provides direct evidence that investors tend to trade attention-grabbing stocks (Barber and Odean, 2008).

Recent years have seen a sharp increase in the use of social media for disseminating financial information. The Securities and Exchange Commission issued a report on April 2, 2013 that makes it clear that companies can use social media outlets such as Facebook and Twitter to announce key information in compliance with Regulation Fair Disclosure (Regulation FD). Blankespoor, Miller, and White (2014) study the role of social media in disseminating earnings news and find that firms disseminating news via Twitter are associated with lower information asymmetry. The evidence is consistent with the notion that disseminating news on Twitter increases the visibility of earnings news by reaching a broad set of investors.

Psychology research shows that individuals put more weight on cues with higher processing fluency in their decision making (Song and Schwarz 2008). An experimental study by Rennekamp (2012) shows that a more readable disclosure with higher processing fluency increases investors' confidence that they can incorporate the disclosed information into valuation decision. Umar (2022) finds that the textual complexity of titles of Seeking Alpha articles is associated with lower investor attention to the news contained in the articles and lower trading activity, consistent with the notion that investors are complexity averse, especially less sophisticated investors. Specifically, in a field experiment setting by holding the article content constant, the paper finds that an article with a complex title receives fewer views from Seeking Alpha users compared to the same article with a less-complicated title.

Miao, Teoh, and Zhu (2016) study the effect of limited attention on the valuation of accruals comparing, ERC, and PEAD between two subsamples of firms, where in one subsample of firms disclose only the balance sheet versus another subsample of firms that disclose both the

balance sheet and the statement of cash flows (SCF) in the earnings press release. The availability of the SCF makes accruals more salient and easier to process for investors with limited attention, whereas the accruals information needs to be inferred from comparative balance sheets when SCF is unavailable at the announcement date. They find strong evidence that SCF disclosure reduces the accruals anomaly, especially in firms with high retail and so less sophisticated investors.

Cardinaels, Hollander, and White (2019) study how investor judgement of earnings announcements is influenced by the automatic summarization of earnings press releases, compared to summaries written by managers who have incentives to strategically choose the tone and content of the summary. They find that investors are less subject to limited attention and value information in the earnings releases more conservatively if the earnings release is accompanied by an automatic summary, which is less biased compared to manager-generated summary.

A substantial literature finds that owing to limited attention, the stock market sometimes underweights relevant non-accounting information signals as well. For example, measures of innovative efficiency and originality based on patents and patent citations positively predict future profits, and seem to be underweighted by the stock market. As a result, such measures predict positive future abnormal stock returns (Hirshleifer, Hsu, and Li 2013, 2018).

Although investors are likely to benefit when the increased salience of information matches its importance to the relevant decision-making, recent studies provide evidence that salience can be a double-edge sword. If salience excites investors to *overweight* salient but transitory earnings news, price overreaction at the time of the announcement may occur. Huang, Nekrasov, and Teoh (2018) use a new salience measure defined as the number of quantitative items in an earnings press release headline and find that high salience is associated with stronger immediate market reaction followed with a subsequent return reversal. Notably, they find that managers take advantage of the headline salience by highlighting good but less persistent financial performance when they plan to sell their shares after the earnings announcements.

More recently, accounting and finance studies start to investigate the influence of non-textual information on salience and investor attention. Nekrasov, Teoh, and Wu (2021) use visuals as a novel proxy for salience and find that visuals in firms' Twitter earnings announcements are associated with more retweets, suggesting greater attention to and engagement with announcement that have visuals. Consistent with managerial opportunism, they find that managers use visuals to attract investor attention, when the quarterly earnings performance is good but less persistent.

Consistent with the expectation that visuals attract investor attention, visuals are associated with a stronger immediate reaction to earnings news and a subsequent return reversal.

Liukonytė, and Žaldokas (2021) study how retail investor behavior responds to TV advertising. They find that TV advertising is associated with an increase in EDGAR search and Google search for financial information within 15 minutes of the airing of the ad, suggesting that advertising increases the attention not only of consumers but also of investors.

Gu, Teoh, and Wu (2022) study how investor sentiment reacts to the use of dynamic visuals—Graphic Interchange Format (GIF), a novel attention-grabbing communication tool that is increasingly used on social media. They find that GIFs are associated with an increase in net bullish sentiment. Moreover, firms discussed with GIFs experience stronger immediate stock returns that are followed by a long-term reversal, consistent with the notion that investors overreact to information presented with GIFs.

### ***Allocation of Attention to Competing Tasks***

When investors and analysts face competing tasks, how do they allocate their attention? Gibbons, Iliev, and Kalodimos (2021) find that analysts access firms' financial filings on EDGAR more frequently for companies with more volatile returns or recent merger and acquisition activity. These findings are consistent with the notion that analysts' attention and information acquisition are driven by the demand for information coming from their clients.

Financial analysts are well known for the extremely long working hours (Bradshaw, Ertimur, and O'Brien, 2017). Their job obligations contain but are not limited to producing research reports, conducting calls, meetings and on-site visits with clients, and meeting with the sales and trading departments within their brokerages. During the earnings announcement seasons, when multiple earnings announcements are issued on the same day, an analyst must decide which announcement to cover first.

Chiu, Lourie, Nekrasov, and Teoh (2021) study whether analysts prioritize firms that are more important to their institutional clients when facing competing tasks during the earnings announcement days. Consistent with expectations, they find a positive association between institutional attention and the order in which an analyst produces research for multiple firms that announce earnings on the same day. In addition, they find that analysts' timely forecasts are rewarded by better career outcomes. Specifically, analysts who issue more timely forecasts in response to institutional investor attention are more likely to be named all-star analysts by

Institutional Investor magazine in the following year, and they are less likely to be demoted to a smaller brokerage.

Similarly, Harford, Jiang, Wang, and Xie (2018) find that analysts make more accurate, frequent, and informative earnings forecasts and recommendations for firms ranked higher within their portfolio based on proxies for the importance of firms to institutional investors. Relatedly, Driskill, Kirk, and Tucker (2020) provide evidence that when analysts face concurrent earnings announcement, they tend to allocate their limited attention to firms that are more important to their careers. Han, Mao, Tan, and Zhang (2021) investigate the allocation of attention by analysts who experience major climatic disasters. They find that disaster-zone analysts are more likely to allocate their attention to firms of higher importance or salience.

Chakrabarty and Moulton (2012) investigate the allocation of attention by market makers. They find that when some stocks handled by a designated market maker have earnings announcements, liquidity is lower for non-announcement stocks handled by the same market maker. Furthermore, they find that the effect of this attention constraint is reduced after the NYSE introduces the Hybrid market, which increases the automation and speed of trading.

### ***The Role of Information Intermediaries***

Recently, researchers have been interested in whether information intermediaries such as business press and equity analysts can mitigate the effect of limited attention by drawing more attention to the news or facilitating processing of the information contained in the announcement.

Zhang (2008) studies the impact of analyst forecast timeliness on market reactions to earnings announcements. She finds that the earnings response coefficient is higher for firm-quarters with timely analyst forecast revisions and the corresponding post-earnings-announcement drift is lower, suggesting that prompt analyst forecast revisions help market participants process and react timely to information disclosed in earnings announcements.

With the revolution in Financial Technology (FinTech), many research firms start to adopt Robo-Analysts to provide investment recommendations. Robo-Analysts utilize the state of art technology such as Natural Language Processing (NLP) and machine learning to produce investment recommendations along with research reports. Coleman, Merkley, and Pacelli (2022) conduct comprehensive analysis comparing the recommendations generated by Robo-Analysts versus human analysts. They find that the automation feature allows Robo-Analysts to revise their recommendations more frequently than human analysts and incorporate information from complex



periodic filings. The evidence overall suggests that Robo-Analysts suffer less from limited attention compared to traditional financial analysts and can be used by the sell-side research industry to produce high quality outputs.

Finance and accounting research also provide ample evidence that highlights the business media as a key player in financial markets. For example, Peress (2014) exploits the newspaper strikes to assess the causal impact of media on market reactions to firm news. He finds that the trading volume falls 12% on strike days. The evidence suggests that disseminating information via business press helps investors become aware of and incorporate firm news into stock prices. Drake, Guest, and Twedt (2014) provide evidence that press coverage of annual earnings announcement mitigate cash flow mispricing. Using high-frequency intraday data, Rogers, Skinner, and Zechman (2016) find that media dissemination affects how market responds to insider trading news in the minutes after its release. Twedt (2016) find that newswire dissemination of management earnings guidance is associated with more efficient incorporation of guidance information into price.

### ***The Effect Timing of Disclosures on Investor Attention to News***

Since the 1930s, both the frequency and length of firm disclosures has considerably increases due to the expanded mandatory disclosure rules and investor demand for information (Paredes, 2003; Radin, 2007). Regulators and practitioners express concerns that investors are overloaded with the ever-increasing amount of disclosed information, which may reduce investor ability to adequately incorporate firm disclosures into decision making (White, 2013; Higgins, 2014). Furthermore, the growing number of concurrent announcements make it more difficult to process information in a timely way. Arif, Marshall, Schroeder, and Yohn (2019) document a growing percentage of firms disclose earnings announcements concurrently with 10-K filing (i.e., approximately 9% in 2002 to 43% by 2016). The concurrent earnings announcement and 10-K filing increase the amount of information at the announcement, which may increase distraction. As a result, investor difficulty in instantaneously processing the greater amount of information in concurrent EA/10-Ks leads to a muted reaction.

Chapman, Reiter, White, and Williams (2019) study managers' response to the potential information overload due to increasing amount of disclosed information. They find that managers combat the information overload by adjusting the timing of mandatory disclosures. Specifically, managers spread the disclosures out over several days when there are multiple disclosures for the

same event date. In addition, managers are also more likely to delay a disclosure when there has been a disclosure made within the three days before the event date.

However, disclosure of supporting financial information in earnings announcements may help investors extract a more precise signal from earnings news. A recent study by Li, Nekrasov, and Teoh (2020) investigate the effect of releasing information in installments rather than all at once. They find that when firms delay disclosure of financial statement items in earnings announcements, investors and analysts underreact to earnings news. The underreaction continues even when the delayed times are fully disclosed in 10-Q filings. This finding is consistent with the maxim that “opportunity knocks but once.” If a firm mismatches the timing of disclosure to when investors and analysts are most attentive (e.g., at the earnings announcement date), then the disclosed earnings information will not be fully impounded into investor valuations.

### ***Investor Limited Attention and Firms’ Strategic Disclosure Choices***

The evidence reviewed so far suggests that (1) retail and institutional investors, sell-side analysts, and other capital market participants such as loan officers and hedge fund managers are subject to limited attention, and (2) market participants’ limited attention affects firms’ stock prices. These findings suggest that managers will take information users’ limited attention into account when making disclosure decisions.

Several studies examine whether managers are being strategic in the choice of disclosure timing by exploiting variation in investor attention. For instance, DellaVigna and Pollet (2009) provide evidence that managers with short-term objectives tend to release bad earnings news on high distraction days (i.e., Fridays), consistent with managers attempting to reduce investor reaction to the negative news. deHaan, Shevlin, and Thornock (2015) provide evidence that the lulls and peaks in investor attention are ex-ante predictable by the managers. Specially, they find that investor attention is lower after trading hours, on busy days, and with less advance notice of the forthcoming announcements. More importantly, they show that managers take advantage of investor limited attention by announcing bad earnings news during periods of low attention.

Managers can also divert investor attention away from negative news by making the information more obfuscated and therefore more difficult to be processed by the users. Bloomfield (2002) proposes a “management obfuscation hypothesis” that managers have more incentives to obfuscate information when earnings news is bad, under the assumption that investors are less likely to fully incorporate disclosed information into stock prices when the information is hard to

digest. Consistent with this hypothesis, Li (2008) provides initial evidence that the readability of annual reports is lower for firms with poor earnings performance.

However, the positive relation between obfuscation and bad news could be driven by (1) managers' incentive to obfuscate investors, or (2) bad news is inherently harder to communicate (Bloomfield, 2008). Lo, Ramos, and Rogo (2017) attempt to disentangle these two explanations by studying the readability of management discussion and analysis section of the annual report (MD&A). They find that MD&A section is more complicated when firms tend to have managed earnings by beating prior year's earnings. This finding goes against the explanation that good news is inherently easier to communicate and provide evidence supporting the management obfuscation hypothesis.

Bushee, Gow, and Taylor (2018) examine the obfuscation in the setting of quarterly earnings conference calls. They argue that obfuscation could prevent analysts from asking follow-up questions about bad news and therefore delay market reaction to the announced bad news. Using a novel approach to disaggregate the linguistic complexity in firm disclosures into obfuscation and information components, they find a positive association between obfuscation and information asymmetry. In the context of mutual funds, deHaan, Song, Xie, and Zhu (2021) provide evidence that funds use unnecessary complex disclosures to obfuscate high fees.

Huang, Teoh, and Zhang (2014) study managers' choice of the tone of words in earnings press releases and its implication for future financial performance. They estimate abnormal positive tone as a measure of tone management and find that the abnormal positive tone is related to lower future earnings and cash flows, suggesting managers' strategic use of tone when disclosing quarterly earnings news. However, investors with limited attention are misled by the abnormal positive tone and do not discount for the negative information about future performance, resulting in an overvaluation of the stock at the time of the earnings announcements. Relatedly, Huang, Nekrasov, and Teoh (2018) find that managers opportunistically headline positive financial information in earnings press release. Nekrasov, Teoh, and Wu (2021) find that managers strategically present earnings news with visuals to attract investor attention, when the quarterly earnings performance is good but less persistent. Both studies find that investors overreact to the salient good earnings news.

Jung, Naughton, Tahoun, and Wang (2018) study whether firms are being strategic when disseminating earnings news on social media. They find that firms are less likely to disseminate

news on Twitter when the quarterly earnings news is bad, especially when firms have high litigation risk. Additionally, they provide evidence that disseminating bad news on social media attracts more attention from the traditional media, as evidenced by the increasing number of negative news articles following the earnings announcements.

The recent surge in inflation across the globe has given renewed interest to research about inflation. One emerging research strand documents inadequate managerial attention to inflation dynamics or inflation risk. Coibion, Gorodnichenko and Kumar's (2018) survey of New Zealand firms find that firms tend to ignore inflation and devote only limited resources to learn about inflation. Coibion, Gorodnichenko, and Ropele (2020) find that firms do not react to inflation, such as increasing prices, until publicly available information about recent inflation is made salient to them. Konchitchki and Xie (2022) consider inattention to inflation risk, and find that managers of firms with high exposure to inflation risk fail to disclose their inflation risk despite the S.E.C.'s Regulation S-K requiring the disclosure of inflation risk factors. These inattention effects are costly as they render firms unprepared to handle problems that arise in an inflationary environment.

## **Summary and Conclusion**

Limited attention theory posits that investor attention is a scarce resource. The growing stream of research reviewed in this chapter finds that the effects of limited attention on capital markets are significant and pervasive. Theoretical and empirical studies show that when some investors are not fully attentive to public information, in general the immediate stock price reaction to the information is incomplete, and future stock prices exhibit a post-announcement drift. The degree of investor inattention explains the magnitude of the stock price underreaction. In some cases, however, when relevant information is ignored because of inattention so there is inadequate discounting of disclosed information (such as the lower persistence of accruals than cash flows), investor overreaction can result followed by a post-announcement reversal.

The literature has identified several factors affecting investor attention to news. These factors include news salience, distraction by competing stimuli, information processing ease, investor sophistication, the economic importance of the firm relative to other firms, the timing of disclosure, and the processing and dissemination of the news by information intermediaries.

Retail investors are more prone to limited attention. However, the effects of limited attention are non-trivial even for professional market participants such as equity analysts, institutional investors, financial data providers, and market makers. Limited investor attention

influences investor trading behavior, stock returns and trading volume. The limited attention of professional equity analysts influences the timing of their forecasts and research reports, the underreaction to public information, and the allocation of their effort across firms they follow. The effects of limited attention can also be observed in the patterns of investor information acquisition through different channels, such as Internet search, the access of firm filings on EDGAR, and the searching and reading activity of professional investors on Bloomberg terminals.

Finally, we discuss how investor limited attention affects firms' choices regarding disclosure timing and format. Studies find that firms disclose bad news during periods of low investor attention and use various qualitative disclosure attributes to increase the salience of favorable information. These managerial choices can decrease stock market efficiency in processing financial information. Mandated disclosures can be double-edged swords and have negative unintended consequences. Regulations on disclosures to increase investor limited attention can be beneficial but they need to balance the tradeoffs of benefits to increased investor attention with the potential negative consequences from managerial responses to the limited attention.

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