Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
The COVID-19 pandemic: How important is face-to-face interaction for information dissemination?

Daniel Cahill, Choy Yeing (Chloe) Ho, Joey W. Yang*

Department of Accounting and Finance, University of Western Australia Business School, 35 Stirling Hwy, Crawley, WA 6009, Australia

ARTICLE INFO

Keywords:
Earnings announcements
Information dissemination
Abnormal mobility
Face-to-face interaction
Investor attention

ABSTRACT

Does face-to-face interaction still facilitate information transfer despite proliferating communication technologies? We use the COVID-19 collapse in such interactions to examine their influence on information flow in the stock market around earnings announcements. Using daily, county-level abnormal mobility of U.S. residents to proxy for face-to-face interaction, we find that firms located in counties with lower abnormal mobility experience a weaker immediate price reaction to earnings announcements and a larger post-announcement drift. Our findings suggest that lower face-to-face interactions dampen price discovery in financial markets, and that investor attention is a potential mechanism of this effect.

1. Introduction

The result is a booming back channel through which facts and body language flow from public companies to handpicked recipients. Participants say they’ve detected hints about sales results and takeover learnings. More common are subtle shifts in emphasis or tone by a company.

—Wall Street Journal, 2015

Does face-to-face interaction still facilitate information transfer in stock markets, despite proliferating communication technologies? Before the widespread use of telecommunications, information was largely disseminated face to face. However, the perpetual development of communication technologies may eliminate the need for face-to-face interactions (Knoke, 1996; Toffler, 1980). The coronavirus pandemic caused an abrupt decrease in those interactions and highlighted the value of virtual communication. While virtual communication through online social networks and mobile communications has been shown to play a role in information dissemination and price efficiency (Brown, Stice, & White, 2015; Hirshleifer, Peng, & Wang, 2021), it remains unclear whether these technologies substitute effectively for face-to-face interactions. In this paper, we exploit the coronavirus stay-at-home restrictions in the United States to evaluate the impact of face-to-face interactions on information flow and asset prices in financial markets.

Face-to-face interactions have been the norm, making it difficult for researchers to find an exogenous setting that affects them on a large scale. COVID-19 brought an abrupt change: with mandated closures and social distancing requirements, face-to-face interactions collapsed. As the number of new cases accelerated, companies and states ordered employees to work from home, fewer individuals used public transport, and bars, restaurants, and shopping centers were closed for business. In a survey, Bloom (2020) found that the number of employees working from home was almost twice as large as the number working on business premises, likely employees of...
essential services. Limited mobility due to COVID-19 restrictions has meant that most forms of pre-COVID face-to-face interactions among institutional investors and between investors and managers, such as broker-hosted conferences, analyst site visits, and private meetings, are unavailable.2

These meetings have been shown to have significant impact on information transfers among companies, institutional investors, and analysts (Bushee, Jung, & Miller, 2011, 2017; Cheng, Du, Wang, & Wang, 2016; Green, Jame, Markov, & Subasi, 2014a, 2014b; Solomon & Soltes, 2015; Soltes, 2014). Using a unique set of proprietary records of all one-on-one meetings between senior managers and institutional investors for a New York Stock Exchange–traded firm, Solomon and Soltes (2015) find that when investors meet privately with managers, they make more informed trading decisions. Using private jet flights to proxy for private meetings between managers and investors, Bushee, Gerakos, and Lee (2018) provide strong evidence that face-to-face private meetings give participating investors an advantage over nonparticipating ones. Cheng, Du, Wang, and Wang (2019) contend that mutual fund managers’ site visits such as field trips to corporate headquarters and production facilities are important ways for investors to collect firm-specific information and make informed trades.

While the pandemic saw increasing adoption of virtual communications, we posit that virtual communications are not perfect substitutes for face-to-face interactions in terms of information sharing. For example, although broker-hosted conferences have been held virtually during the pandemic, brokers and managers cannot share private conversations during social events. Studies in cognitive neuroscience find that compared to face-to-face communication, virtual communication reduces an individual’s ability to process information (Graetz, Boyle, Kimble, & Garloch, 1998; Heninger, Dennis, & Hilmer, 2006; Robert & Dennis, 2005; Straus, 1996). Also, distractions from simultaneous multiple conversations are more likely in virtual communications than in face-to-face communications (Dennis, 1996; Dennis & Valacich, 1994; Stromso, Grettum, & Lycke, 2007). And viewing another person live has a more pronounced impact on a person’s neural processing than viewing the other person on a computer screen (Freeth, Foulsham, & Kingstone, 2013; Ponkanen, Alhoniemi, Leppanen, & Hietanen, 2011). In particular, the findings about attention blocking and tendency to distractions suggest that virtual communications may exacerbate the limits on investor attention (Bernard & Thomas, 1989), which delay information diffusion (DellaVigna & Pollet, 2009; Hirshleifer, Lim, & Teoh, 2009).

The sudden drop in mobility and increased duration spent at home during the coronavirus pandemic provide an ideal environment to study the role of face-to-face interactions in stock market information dissemination. Using earnings announcements by U.S. firms from February 15 to August 31, 2020, and U.S. county-level abnormal mobility measures from Google’s Community Mobility reports as a proxy for face-to-face interactions,3 we examine whether face-to-face interactions play an important role in facilitating information dissemination and the market’s response to earnings news. While neoclassic models implicitly assume that public information is effortlessly obtained and instantly processed by the market (Merton, 1987), a voluminous empirical literature finds evidence that the market underreacts to earnings announcements (Ball & Brown, 1968; Bernard & Thomas, 1989; Foster, Olsen, & Shevlin, 1984). We predict that lower face-to-face interactions will decrease information flow into price, increasing this underreaction.

Since our proxy for face-to-face interactions is a measure that varies across counties, we expect the impact of face-to-face interactions on information dissemination to affect stocks headquartered in the same county (i.e., local stocks). This assumption is backed by empirical evidence showing investors’ preference for home-country stocks, or stocks of firms that are headquartered nearby (Coval & Tobias, 1999; Grinblatt & Keloharju, 2000; Huberman, 2001). Since local investors and local information affect dissemination of stock market information about local stocks (see for example, Brown et al., 2015; Engelberg & Parsons, 2011; Ivković & Weisbenner, 2007; Loughran & Schultz, 2004; Peress, 2014; Shive, 2012), we expect the decrease in county-level abnormal mobility to inhibit such dissemination as face-to-face interactions among local investors decrease. And local bias is not limited to individual investors. A recent study by Ellis, Madureira, and Underwood (2020) finds that a fund invests significantly more in firms that become more proximate following the introduction of direct flights, and that these more proximate investments perform better. Therefore, we expect face-to-face interactions among institutional traders to affect information dissemination for local stocks.

We use Google’s COVID-19 Community Mobility Reports to proxy the extent of face-to-face interaction. This dataset shows the abnormal mobility in total number of visitors to nonresidential locations—classified as retail and recreation locations, grocery stores and pharmacies, parks, transit stations, and workplaces—as well as the abnormal change in length of stay at residential places, within a given geographic (county-level) area. Specifically, Google constructs each of these county-level abnormal mobility measures as the percentage difference from the median value taken from the same day of the week between January 3 and February 6, 2020, for the corresponding location. The earliest date for which this abnormal mobility measure is made available is February 15, 2020. We average abnormal nonresidential mobility across its four categories. Naturally, we expect abnormal residential mobility (Residential) to trend in the opposite direction from abnormal nonresidential mobility (Nonresidential). Mobility restrictions increase people’s time spent at home and decrease face-to-face interaction, while abnormal nonresidential mobility captures activities from workplaces and other public areas and therefore increases face-to-face interaction. To check the robustness of our findings, we conduct the same analysis using measures of four categories of nonresidential abnormal mobility.

Guided by findings in the neuroscience literature that face-to-face interaction plays a role in evoking individual attention, which is a requirement for investors’ information acquisition, trading activity, and price discovery (Ben-Rephael, Da, & Israelsen, 2017; Drake, 2015), we analyze the impact of abnormal mobility on stock returns.

2 “Company executives often make presentations to investors at conferences sponsored by securities firms and have one-on-one meetings with large investors on the side. Some companies host investor meetings at their headquarters, or their executives may go on ‘roadshows’ to meet with shareholders and potential investors.” (https://www.wsj.com/articles/how-some-investors-get-special-access-to-companies-1443407097)
3 Google captures the aggregated mobility of anonymous Google users who have opted into the location history service. Google LLC, 2021, Google COVID-19 Community Mobility Reports. Retrieved August 31, 2020, from https://www.google.com/covid19/mobility/.
We argue that investor attention is a mechanism through which face-to-face interactions influence information diffusion in the stock market. We expect the shock to mobility during the COVID-19 pandemic to affect institutional and retail investors’ attention differently. If COVID-19 does not change the method of reporting information or the instruments that institutional investors use to retrieve information, we focus on information previously disseminated through broker-hosted conferences, private face-to-face meetings, analyst/investor site visits, and so forth. The decline in this kind of face-to-face interaction should decrease institutional attention.

In contrast, since retail traders are more likely to rely on easily accessible public information, and working from home will give them more exposure to news via TV or the Internet, we expect their attention to increase. Chia and Zhong (2020) and Ortmann, Pelster, and Wengerek (2020) report that retail traders’ participation in financial markets has increased during the COVID-19 period, given more time to observe and manage their trading positions at home. This finding is corroborated by Ribeiro et al. (2020), who report an increase in demand for Wikipedia information when abnormal mobility is low. In this paper, we use search activity on Bloomberg terminals as a proxy for institutional investor attention, and company Wikipedia page views as our proxy for retail attention.

We contribute to the literature in several ways. First, our study is related to the literature on the impact of telecommunications (telecommuting, virtual teams, online communities, videoconferencing, etc.) on people’s interactions and work performance (see Ahuja, Galletta, & Carley, 2003; Faraj & Johnson, 2011; Ferran & Watts, 2008; O’Leary & Cummings, 2007).

Second, our results add to a stream of literature examining the influence of local investors and local information on stock market information dissemination (Brown et al., 2015; Jacobs & Weber, 2012; Loughran & Schultz, 2004; Peress, 2014; Shive, 2012). Studies show the influence of social interaction and word-of-mouth communication among local individuals on stock market participation and information dissemination (Han & Yang, 2013; Hirshleifer et al., 2021; Hong, Kubik, & Stein, 2004; Ivković & Weisbenner, 2007; Shive, 2010). However, these studies do not specify whether these social interactions happen in the same room or over the phone or in an online social network. Since the mobility restrictions during COVID-19 ensure that the decision to stay at home is not an endogenous choice, our study does not suffer the common drawback of using social interaction proxies that may be affected by individuals’ personality traits associated with information dissemination.

Third, we add to the growing literature covering the impact COVID-19 is having on financial markets. The prevalence of misinformation and heterogeneous beliefs, together with policies that have restricted travel and disrupted supply chains, has caused great uncertainty regarding the recovery from the virus’s damage to the global economy. This uncertainty has created significant volatility in financial markets (Albulescu, 2020; Baig, Butt, Haroon, & Risvi, 2021; Baker et al., 2020). The current literature has explored the pandemic’s impact on commodities (Gharib, Mefteh-Wall, & Jabeur, 2020; Salisu, Akanni, & Raheem, 2020); company disclosures (Wang & Xing, 2020); safe havens and cryptocurrencies (Cheema, Faff, & Szulczuk, 2020); trading behavior (Chia & Zhong, 2020; Ortmann et al., 2020); and government policy (Narayan, Phan, & Liu, 2020; Zaremba, Kizys, Aharon, & Demir, 2020). However, we find no studies exploring the impact of abrupt changes to mobility in the capital markets literature. Our study attempts to address this gap.

The remainder of the paper is organized as follows. Section 2 describes the mobility data. Section 3 describes the other data and outlines the empirical strategy employed in the paper. Sections 4 and 5 present the main and robustness test results respectively. Finally, Section 6 concludes the paper.

2. Mobility data

To proxy for face-to-face interactions, we use Google’s Community Mobility Reports, which show mobility trends by region for six distinct categories: retail and recreation locations, grocery stores and pharmacies, parks, transit stations, workplaces, and residences. Except for residential mobility, all other categories are measured as the percentage change in number of visitors to a given category and location, compared to a baseline. Residential mobility measures the change in length of stay in residential areas, compared to a baseline. This baseline benchmarks the median mobility (or length of stay) for each day of the week during the 5-week period from January 3 to February 6, 2020. For example, for March 31, 2020 (Tuesday), a negative value represents a decrease in mobility compared to the median Tuesday mobility value during the 5-week baseline period.

The main abnormal mobility measures we focus on in this paper are Google’s abnormal nonresidential mobility, denoted as Nonresidential (computed from the average of abnormal mobility for retail and recreation locations, grocery stores and pharmacies, transit stations, and workplaces) and abnormal residential mobility, denoted as Residential, from 1698 counties in the United States.

The availability of public information does not imply that all market participants have access to the same information instantaneously. Information dissemination depends on the extent of investors’ demand for information, which is in turn positively related to investor attention (Drake et al., 2012). However, the longstanding notion is that investors have limited attention (Bernard & Thomas, 1989), which leads to less immediate information diffusion (DellaVigna & Pollet, 2009; Hirshleifer et al., 2009). Recent studies show that investor attention can be influenced by product market advertising (Focke et al., 2020; Lou, 2014), social media activity such as tweeting (Bhagwat & Burch, 2016) and Facebook connectivity (Hirshleifer et al., 2021), and earnings notifications (Chapman, 2018).

See for example https://www.wsj.com/articles/individual-investor-boom-reshapes-u-s-stock-market-115988662007?mod=searchresults&pos=1&refpos=2&mod=article_inline, and https://www.wsj.com/articles/coronavirus-turmoil-free-trades-draw-newbies-into-stock-market-11588158001.

https://www.google.com/covid19/mobility/data_documentation.html?hl=en#about-this-data
from February 15 to August 31, 2020. We exclude the “parks” mobility category for two reasons. The pervasive implementation of lockdowns was followed by the closure of gyms and recreation centers. Ding, del Pozo Cruz, Green, and Bauman (2020) show that individuals’ interest in exercise increases after lockdowns, likely because of more discretionary time, substitution for other activities, and increased health awareness. Second, this mobility is also influenced by factors unrelated to lockdowns, such as season, weather, and public holidays, making this mobility category less reliable than other categories. We assume that lower abnormal nonresidential mobility (higher abnormal residential mobility) captures lower face-to-face interactions as people spend less time at work and public places and more time at home.

Fig. 1 shows how abnormal nonresidential (residential) mobility has trended down (up) from February to August 2020 during the COVID-19 period.

3. Data and methods

We obtain earnings announcement dates and analyst forecasts from IBES over a sample period of February 15 to August 31, 2020. Information on firms’ headquarters location and financial performance is retrieved from Compustat and is matched with each county from the mobility database through firms’ postcodes. Stock price data come from Refinitiv’s Datastream.

3.1. Unexpected earnings

Unexpected earnings (UE) are commonly measured as the difference between actual earnings and some consensus measure, such as the average of analyst forecast errors (AFE). However, past studies have widely documented professional analysts’ colluding in their earnings forecasts to follow a certain desired pattern (e.g., continual miss or overshoot), causing bias in the analyst forecast errors. This bias further flows into price reactions around the earnings announcement, commonly measured by the cumulated abnormal return (CAR), which is regressed on the AFE (Kothari & Warner, 2007; Lyon, Barber, & Tsai, 1999). Therefore, we adopt a novel measure for unexpected earnings developed by Chiang, Dai, Fan, Hong, and Tu (2019). Based on the fraction of analyst forecasts that miss on the same side (denoted as FOM), this new measure offers a better approximation than the AFE. Following Chiang et al. (2019), we compute FOM as follows:

$$FOM = \frac{K}{N} \cdot \frac{M}{N},$$

where $N$ is the total number of analyst forecasts for a given quarter, $K$ is the number of forecasts that are lower than the actual earnings (i.e., misses), and $M$ is the number of forecasts that are higher than the actual earnings (i.e., overshoots). FOM ranges between one and negative one and represents the fraction of net misses in all forecasts.

We then create a rank variable for unexpected earnings (UE) by sorting FOM into five subgroups. The purpose of using a rank

---

7 The benchmark period for mobility, January, is likely to have few visits to parks.
measure for unexpected earnings instead of a raw measure is to control for the nonlinear relationship between CAR and UE as well as any confounding effects from extreme values (Kothari, 2001).

3.2. CAR and control variables

Following studies on earnings announcement returns, we compute the cumulative abnormal return (CAR) in two distinct event windows: 2 days surrounding the earnings announcement date (CAR[0,1]) and a long-term post-earnings announcement window spanning day 2 to day 55 (CAR[2,55]). We calculate abnormal return using the Fama-French-Carhart four-factor model with an estimation window of [−120, −21]:

\[
AR_{it} = R_{it} - R_f = \left[ \alpha + \beta_1 (R_{m,t} - R_f,t) + \beta_2 \text{SMB}_t + \beta_3 \text{HML}_t + \beta_4 \text{MOM}_t \right]
\]

(2)

\[
\text{CAR}_i = \sum_{t=1}^{n} AR_{it},
\]

(3)

where \(AR_{it}\) denotes the abnormal return for stock \(i\) on day \(t\), and \(R_m - R_f\), \(\text{SMB}\), \(\text{HML}\), and \(\text{MOM}\) are the Fama-French-Carhart four factors: excess return on the market, size effect, value premium, and momentum, respectively. We obtain these variables from Kenneth French’s website. \(\text{CAR}[0,1]\) measures immediate price responses to earnings information, while \(\text{CAR}[2,55]\) captures delayed responses.\(^8\)

3.3. Model specification—return reaction

To test the effect that reduced face-to-face interaction has on immediate and delayed market reactions to earnings announcements, we regress \(\text{CAR}[0,1]\) and \(\text{CAR}[2,55]\) on \(\text{UE}\); \(\text{Mobility}\), which measures abnormal mobility and hence proxies for face-to-face interaction; the interaction between \(\text{UE}\) and \(\text{Mobility}\); control variables; and industry fixed effects:

\[
\text{CAR}_i = \alpha + \gamma_1 \text{UE}_i + \gamma_2 \text{Mobility}_i + \gamma_3 \text{UE} \times \text{Mobility}_i + \sum_{j=1}^{n} \gamma_j \text{Controls}_i + \delta \text{FE}_i.
\]

(4)

\(\text{UE}\) is unexpected earnings as described in Section 3.1. \(\text{Mobility}\) represents the abnormal nonresidential (Nonresidential) and abnormal residential (Residential) mobility we run Model (4) for each measure of abnormal mobility. \(\text{Nonresidential (Residential)}\) is the average abnormal nonresidential (residential) mobility over \([-10, -1], [-5, -1],\) and \([-3, -1]\) estimation windows before the earnings announcement. The key variable of interest is the interaction between \(\text{Mobility}\) and \(\text{UE}\), which captures the marginal effect of abnormal mobility on the market reaction to earnings news.\(^9\) \(\text{FE}\) are industry fixed effects. \(\text{Controls}\) denotes a set of commonly used firm-specific variables.

The firm-specific controls include firm size measured by the natural logarithm of total assets (\(\text{Ln Size}\)); return on assets (\(\text{ROA}\)) measured as income before extraordinary items divided by total assets; leverage (\(\text{Leverage}\)), which is long-term debt plus short-term debt, divided by book value of total assets; and book-to-market ratio (\(\text{BTM}\)), which is the book value of common equity divided by the market capitalization. Hirshleifer, Lim, and Teoh (2009) show weaker market reactions to news when investors are distracted. As our whole sample period is in the pandemic, it is important to control for the possibility that media coverage of COVID-19 developments may largely distract investor attention from company earnings announcements. We therefore include two proxies for investor distraction, \(\Delta \text{New Death}_Q^{\text{in}5}\) and \(\Delta \text{New Case}_Q^{\text{in}5}\). We first calculate the average daily changes in the number of new cases and deaths over the 10 days before a company’s earnings announcement. We then define the dummy variable \(\Delta \text{New Death}_Q^{\text{in}5}\) as one if the average change in new deaths is in the top quintile of the sample, and zero otherwise. \(\Delta \text{New Case}_Q^{\text{in}5}\) is defined similarly using the average change in new cases. We also include a control variable for market trading conditions around the earnings announcement, measured as the average daily trading volume over the 3 days preceding the announcement (\(\text{Volume}\)). Appendix A provides a detailed description of all variables used in the analyses.

A positive coefficient (\(\gamma_3\)) for \(\text{UE} \times \text{Nonresidential}\) in the regression of \(\text{CAR}[0,1]\) in Model (4) would indicate that lower \(\text{Nonresidential}\) mobility (such as work-from-home arrangements)—and thus lower face-to-face interaction—is associated with weaker announcement price reaction to earnings news. Given that \(\text{Residential}\) is a mirror-image of \(\text{Nonresidential}\), we expect the coefficient for the interaction term (\(\text{UE} \times \text{Residential}\)) to be negative. In line with the above prediction that face-to-face interaction disseminates information, reduced face-to-face interaction should increase post-earnings-announcement drift (PEAD). Therefore, we expect a negative (positive) coefficient on \(\text{UE} \times \text{Nonresidential} / \text{Residential}\) in the regression for \(\text{CAR}[2,55]\).

\(^8\) Our main results remain unchanged after we estimate \(\text{CAR}\) using the market model (CAPM).

\(^9\) This coefficient is also known as the earnings response coefficient (i.e., the sensitivity of stock returns to earnings news) in other related studies (see Drake et al., 2012).
that companies in counties with higher (lower) CAR\([2,55]\) experience a more immediate response to earnings news. The coefficient for the interaction between Residential and \(UE\) is negative and statistically significant at the 1% level. These findings suggest that abnormal returns for positive (negative) unexpected earnings continue to drift upwards (downwards) up to 55 days after the announcement.

The results for the baseline regression for CAR\([0,1]\) and CAR\([2,55]\) specified in Model (4) are presented in panels A and B of Table 3, respectively. Columns 1–3 (4–6) present the results for Nonresidential (Residential) measured 3, 5, and 10 days before the earnings announcement. The variable of interest is the interaction term between Mobility and \(UE\).

Since we expect Nonresidential (Residential) to be positively (negatively) associated with face-to-face interaction, the relationship between Nonresidential (Residential) and CAR\([0,1]\) should be positive (negative). In columns 1–3, we find that the interaction between Nonresidential and \(UE\) has a positive coefficient that is statistically significant at the 1% level. This suggests that companies in counties with higher abnormal nonresidential mobility experience a more immediate response to earnings news. Given the high negative correlation between Nonresidential and Residential, the effect of Residential on the market reaction is expected to be opposite; and indeed, columns 4–6 show that higher Residential mobility is associated with a lower immediate response to earnings news. The coefficient for the interaction between Residential and \(UE\) is negative and statistically significant at the 1% level. These findings suggest that companies in counties with higher (lower) Nonresidential (Residential) mobility—and therefore with more face-to-face interaction—experience greater immediate price response to earnings news. Overall, these results provide initial support for the idea that reduced face-to-face interaction impairs the dissemination of stock market information.

Panel B of Table 3 presents the results for the PEAD regression, measured by CAR\([2,55]\). We find that higher Nonresidential and lower Residential mobility lead to lower CAR\([2,55]\), indicating that face-to-face interactions disseminate information on the earnings
Table 2
Pearson and Spearman correlation coefficients.

|               | CAR[0,1] | CAR[2,55] | Nonresidential | Residential | UE       | ROA       | Total Assets | Leverage    | BTM       | Volume     | ΔNew_Death_Qin5 | ΔNew_Case_Qin5 |
|---------------|----------|-----------|----------------|-------------|----------|-----------|--------------|-------------|-----------|------------|----------------|----------------|
| CAR[0,1]      | 1        | 0.007     | -0.016         | 0.003       | 0.179*   | 0.030     | 0.036*       | 0.022       | 0.005     | 0.004      | -0.044*        | 0.005          |
| CAR[2,55]     | 0.000    | 1         | 0.055*         | -0.049*     | 0.090*   | 0.011*    | 0.067*       | 0.080*      | 0.002*    | 0.046*     | 0.119*         | -0.039*        |
| Nonresidential| -0.047*  | 0.041*    | 1              | -0.955*     | 0.017    | 0.052*    | 0.056*       | 0.173*      | 0.115*    | 0.110*     | -0.185*        | -0.247*        |
| Residential   | 0.054*   | -0.039*   | -0.966*        | 1           | -0.011   | -0.054*   | -0.055*      | -0.164*     | -0.106*   | -0.014     | 0.216*         | 0.238*         |
| UE            | 0.178*   | 0.083*    | 0.021          | -0.015      | 1        | 0.128*    | 0.135*       | 0.014       | -0.018    | 0.107*     | 0.133*         | -0.046*        |
| ROA           | 0.062*   | 0.090*    | 0.084*         | -0.076*     | 0.112*   | 1         | 0.519*       | 0.135*      | 0.000     | 0.156*     | 0.167*         | 0.002          |
| Total Assets  | -0.009   | -0.009    | -0.075*        | 0.068*      | 0.047*   | 0.185*    | 1            | 0.378*      | 0.164*    | 0.600*     | 0.221*         | -0.012         |
| Leverage      | 0.011    | 0.064*    | 0.134*         | -0.141*     | -0.004   | 0.159*    | 0.067*       | 1           | -0.078*   | 0.262*     | 0.008          | -0.029         |
| BTM           | 0.058*   | 0.082*    | 0.121*         | -0.096*     | -0.009   | 0.087*    | 0.008        | -0.101*     | 1         | -0.057*    | 0.013          | -0.045*        |
| Volume        | 0.013    | 0.060*    | -0.030         | 0.029       | 0.048*   | 0.073*    | 0.534*       | 0.113*      | 0.065*    | 1          | 0.173*         | -0.061*        |
| ΔNew_Death_Qin5| -0.031   | 0.121*    | -0.220*        | 0.240*      | 0.136*   | 0.117*    | 0.178*       | -0.013      | -0.039*   | 0.117*     | 1              | -0.238*        |
| ΔNew_Case_Qin5| -0.013   | -0.041*   | -0.264*        | 0.264*      | -0.044*  | 0.022     | -0.013       | -0.030      | -0.048*   | -0.045*    | -0.238*        | 1              |

Notes: CAR[0,1] is cumulative abnormal returns in the event window [0, 1], and CAR[2,55] is cumulative abnormal returns in the event window [2, 55], calculated from Fama and French’s 4-factor model. Nonresidential is the average of four county-level abnormal mobility measures, for retail and recreation locations, grocery stores and pharmacies, transit stations, and workplaces. Residential is abnormal residential mobility. We use the average abnormal mobility over a 3-day pre-event window [−3, −1]. Appendix A provides a detailed description of all other variables.

* Indicates significance at the 5% level.
Table 3  
Mobility and market reaction.

### Panel A: CAR[0,1]

|       | (1)     | (2)     | (3)     | (4)     | (5)     | (6)     |
|-------|---------|---------|---------|---------|---------|---------|
|       | 3-day   | 5-day   | 10-day  | 3-day   | 5-day   | 10-day  |
| **UE** | 0.019*** | 0.019*** | 0.018*** | 0.019*** | 0.019*** | 0.019*** |
|        | (9.20)  | (9.20)  | (8.87)  | (8.47)  | (8.49)  | (8.52)  |
| Nonresidential | −0.111*** | −0.111*** | −0.100*** | −0.542** | (−5.39) | (−4.97) |
|        | (−5.24) | (−5.39) | (−4.97) | (−8.20) | (−9.03) | (−7.92) |
| **UE × Nonresidential** | 0.019*** | 0.019*** | 0.017*** | (3.45)  | (3.41)  | (2.98)  |

Residential

|       | 0.224*** | 0.232*** | 0.218*** | (5.38)  | (5.44)  | (5.29)  |
|       | (5.38)  | (5.44)  | (5.29)  | (5.38)  | (5.44)  | (5.29)  |
| **UE × Residential** | −0.035*** | −0.034*** | −0.034*** | (−3.04) | (−3.02) | (−3.02) |

|       | 0.012*** | 0.012*** | 0.012*** | 0.011*** | 0.011*** | 0.011*** |
|       | (3.67)  | (3.67)  | (3.67)  | (3.44)  | (3.49)  | (3.50)  |
| **BTM** | 0.020*** | 0.020*** | 0.020*** | 0.021*** | 0.020*** | 0.021*** |
|        | (2.82)  | (2.83)  | (2.80)  | (2.88)  | (2.87)  | (2.87)  |
| **ROA** | 0.015*  | 0.015*  | 0.015*  | 0.016** | 0.017** | 0.016** |
|        | (1.80)  | (1.79)  | (1.76)  | (1.99)  | (2.00)  | (1.97)  |
| **Leverage** | 0.01**  | 0.01**  | 0.01**  | 0.01**  | 0.01**  | 0.01**  |
|        | (0.48)  | (0.50)  | (0.57)  | (0.55)  | (0.56)  | (0.60)  |
| **Ln_Size** | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |
|        | (0.48)  | (0.50)  | (0.57)  | (0.55)  | (0.56)  | (0.60)  |
| **Constant** | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |
|        | (0.48)  | (0.50)  | (0.57)  | (0.55)  | (0.56)  | (0.60)  |
| **N** | 3429    | 3430    | 3433    | 3494    | 3494    | 3494    |
| **Industry FE** | YES    | YES    | YES    | YES    | YES    | YES    |
| **Adj. R-squared** | 0.05    | 0.05    | 0.05    | 0.05    | 0.05    | 0.05    |

### Panel B: CAR[2,55]

|       | (1)     | (2)     | (3)     | (4)     | (5)     | (6)     |
|-------|---------|---------|---------|---------|---------|---------|
|       | 3-day   | 5-day   | 10-day  | 3-day   | 5-day   | 10-day  |
| **UE** | 0.003   | 0.002   | 0.008   | 0.001   | 0.000   | 0.007   |
|        | (0.41)  | (0.37)  | (1.22)  | (0.11)  | (0.04)  | (0.92)  |
| Nonresidential | 0.205*** | 0.203*** | 0.182*** | (3.08)  | (3.06)  | (2.77)  |
|        | (3.08)  | (3.06)  | (2.77)  | (3.08)  | (3.06)  | (2.77)  |
| **UE × Nonresidential** | −0.043** | −0.043** | −0.022  | (−2.32) | (−2.37) | (−1.23) |

Residential

|       | −0.466*** | −0.476*** | −0.435*** | (−3.44) | (−3.58) | (−3.26) |
|       | (−3.44)  | (−3.58)  | (−3.26)  | (−3.44) | (−3.58) | (−3.26) |
| **UE × Residential** | 0.096**  | 0.097*** | 0.057    | (2.58)  | (2.65)  | (1.53)  |

|       | 0.039*** | 0.039*** | 0.037*** | 0.040*** | 0.039*** | 0.038*** |
|       | (3.62)  | (3.62)  | (3.50)  | (3.75)  | (3.73)  | (3.64)  |
| **BTM** | 0.082*** | 0.082*** | 0.080*** | 0.078*** | 0.078*** | 0.076*** |
|        | (3.49)  | (3.49)  | (3.41)  | (3.37)  | (3.37)  | (3.27)  |
| **ROA** | 0.114*** | 0.114*** | 0.109*** | 0.113*** | 0.109*** | 0.109*** |
|        | (4.14)  | (4.15)  | (3.99)  | (4.22)  | (4.21)  | (4.05)  |
| **Leverage** | −0.019*** | −0.019*** | −0.019*** | (−4.47) | (−4.44) | (−4.39) |
|        | (−4.47) | (−4.44) | (−4.39) | (−4.50) | (−4.48) | (−4.42) |
| **Ln_Size** | 0.006*** | 0.006*** | 0.006*** | (3.02)  | (3.00)  | (3.00)  |
|        | (3.02)  | (3.00)  | (3.00)  | (3.04)  | (3.05)  | (3.05)  |
| **Constant** | 0.111*** | 0.111*** | 0.110*** | (6.94)  | (6.87)  | (7.41)  |
|        | (6.94)  | (6.87)  | (7.41)  | (6.99)  | (7.03)  | (7.53)  |
| **N** | 3429    | 3430    | 3433    | 3494    | 3494    | 3494    |
| **Industry FE** | YES    | YES    | YES    | YES    | YES    | YES    |
| **Adj. R-squared** | 0.05    | 0.05    | 0.05    | 0.05    | 0.05    | 0.05    |
announcements and thus lead to less drift afterwards. Our results corroborate the finding of greater announcement market reactions in panel A, strengthening our main conjecture that reduced face-to-face interactions due to COVID-19 restrictions impede information dissemination in financial markets.

Our results complement existing studies by Hong et al. (2004), Ivković and Weisbenner (2007), and Pool, Stoffman, and Yonker (2015), who show that social interactions facilitate information transfer and influence individuals’ investment choices. Additionally, our findings are related to studies on the relationship between social networks among finance professionals and financial performance (Baik, Kang, & Kim, 2010; Cohen, Frazzini, & Malloy, 2008; Hochberg, Ljungqvist, & Lu, 2007; Hwang & Kim, 2009; Shiller & Pound, 1989). While these studies do not differentiate between face-to-face and online interactions, we show the importance of face-to-face interactions in disseminating stock market information. This finding has important implications even in normal times, as some scholars have questioned the importance of face-to-face interactions given the advancement of telecommunications.

4.2. Alternative measures for face-to-face interactions

To verify the main finding in Table 3, we use four alternative proxies for face-to-face interactions using different variations of Residential mobility. First, as state governments brought in COVID-related restrictions at different times, it is worthwhile to examine the influence of relative abnormal mobility across counties. Although Google’s mobility data measure the increment in human mobility against a benchmark period in a given location, they do not capture the difference across counties at any given point of time. To do this, we first compute the median daily mobility across all counties, and then take the increment from this median to obtain daily abnormal residential mobility. We then compute the average incremental residential (Inc_Residential) mobility over the 3 days before the earnings announcement (Table 4).

Second, if lower mobility, which takes the value of one if the average readership score over the estimation window is between 3 and 4, and zero otherwise.10

To proxy for retail attention, we use company Wikipedia page views (see Focke, Ruenzi, & Ungeheuer, 2020).11 We use Wikipedia as our proxy for retail attention rather than Google’s Search Volume Index (SVI) for two reasons. First, we can unambiguously identify company Wikipedia pages, whereas searches using Google SVI can be problematic since company names can be difficult to distinguish from unrelated search terms (see for example Da, Engelberg, & Gao, 2011). Second, Wikipedia reports the data at a higher (daily) frequency. The variable used in the analysis, Wiki_Dum, captures the abnormal Wikipedia page views over a 10-day estimation window [−10, −1]. Specifically, we first sort the average daily Wiki page views over the estimation window into quintiles, then code Wiki_Dum as one if the page views for a given company fall into the top quintile, and zero otherwise.

Table 5 reports estimated results from regressing investor attention on abnormal mobility, controlling for firm-specific variables, market trading conditions, and industry fixed effects. We calculate Residential and Nonresidential mobility over the same 10-day window as the investor attention measures. In column 1 (2), where the dependent variable is AIA, we find that the coefficient on Nonresidential (Residential) is significantly positive (negative), in accord with our expectation that lower face-to-face interaction leads to lower institutional attention around company earnings announcements. Our results imply that institutional attention decreases as access to workplaces and public areas such as bars and restaurants falls.

To investigate the influence of abnormal mobility on retail investor attention, we turn to columns 3 and 4 in Table 5, where the dependent variable is Wiki_Dum. In contrast to the above results for institutional investor attention, we find a statistically significant negative (positive) coefficient on Nonresidential (Residential), implying that as abnormal mobility decreases and people spend more time at home, retail investor attention to companies increases 10 days before earnings announcements. This is consistent with Ribeiro et al.’s (2020) findings that a decrease in abnormal mobility is associated with an increase in the demand for information from Wikipedia.

As we expected, these results show that face-to-face interaction influences institutional attention and retail attention in opposite ways, and that the relationship between declining mobility due to COVID-19 restrictions and underreaction to earnings news works through institutional attention, not retail attention.

---

10 We have also followed Ben-Rephael et al. (2017) to compute the continuous average readership, AIAC, over the estimation window. For readership values of 0, 1, 2, 3, and 4, AIAC takes values of −0.350, 1.045, 1.409, 1.647, and 2.154, respectively. In untabulated calculations, we find similar results, in which the coefficient on Non-Residential (Residential) is positive (negative).

11 Wikipedia contains 2019 distinct publicly listed companies, generating over 450,000 page views per day (Focke et al., 2020).
Table 4
Alternative measures of mobility.

Panel A: CAR[0,1]

|                | (1)          | (2)          | (3)          | (4)          |
|----------------|--------------|--------------|--------------|--------------|
| UE             | 0.016***     | 0.016***     | 0.015***     | 0.016***     |
| Inc_Residential| 0.253***     | (3.37)       |              |              |
| UE × Inc_Residential | −0.059*** | (−2.77)     |              |              |
| Residential_Dum| 0.030***     | (3.40)       |              |              |
| UE × Residential_Dum | −0.010*** | (−4.10)     |              |              |
| Lockdown_Dum   |              |              | 0.022**      |              |
| UE × Lockdown_Dum |          |              | −0.008***    | (−3.02)      |
| Constant       | 0.092***     | (3.36)       | 0.086***     | (3.14)       |

|                |                |            |             |             |
|----------------|----------------|------------|-------------|-------------|
| UE × Lockdown_Count |          | −0.004***  | (−3.60)     |             |
| BTM            | 0.011***      | (3.29)     | 0.010***    | (3.12)      |
| ROA            | 0.019***      | (2.71)     | 0.018**     | (2.67)      |
| Leverage       | 0.013         | (1.54)     | 0.011       | (1.34)      |
| Ln_Size        | −0.001        | (−0.91)    | −0.002      | (−1.23)     |
| Volume         | 0.000         | (0.77)     | 0.001       | (1.03)      |
| ΔNew_Death_Qin5| −0.008        | (−1.56)    | −0.005      | (−0.95)     |
| ΔNew_Case_Qin5 | −0.016***     | (−3.27)    | −0.013***   | (−2.61)     |
| Constant       | −0.092***     | (−3.36)    | −0.086***   | (−3.14)     |
| N              | 3494          |            | 3503        |             |
| Industry FE    | YES           |            | YES         |             |
| Adj. R-squared | 0.04          |            | 0.05        |             |

Panel B: CAR[2,55]

|                | (1)          | (2)          | (3)          | (4)          |
|----------------|--------------|--------------|--------------|--------------|
| UE             | 0.008        | (1.35)       |              |              |
| Abn_Residential| −0.755***    | (−3.10)      |              |              |
| UE × Abn_Residential | 0.141**    | (2.05)       |              |              |
| Residential_Dum|              |              | −0.053*      | (−1.87)      |
| UE × Residential_Dum |          |              | 0.013        | (1.62)       |
| Lockdown_Dum   |              |              | −0.032       | (−1.03)      |
| UE × Lockdown_Dum |          |              | 0.014*       | (1.65)       |
| Constant       | −0.017       | (−1.52)      |              |              |

|                |                |            |             |             |
|----------------|----------------|------------|-------------|-------------|
| UE × Lockdown_Count |          | 0.007**    | (2.22)      |             |
| BTM            | 0.038***      | (3.62)     | 0.040***    | (3.77)      |
| ROA            | 0.075***      | (3.24)     | 0.081***    | (3.48)      |
| Leverage       | 0.113***      | (4.20)     | 0.118***    | (4.39)      |
| Ln_Size        | −0.019***     | (−4.58)    | −0.019***   | (−4.59)     |

(continued on next page)
Notes: This table presents estimated results from the OLS regression of institutional attention (Investor attention and mobility. Table 5) and alternative abnormal mobility measures and controls with industry fixed effects. –

Table 4

Panel B: CAR[2,55]

|                | (1)     | (2)     | (3)     | (4)     |
|----------------|---------|---------|---------|---------|
| Volume         | 0.006*** | 0.006*** | 0.006*** | 0.006*** |
|                | (3.08)  | (2.83)  | (2.80)  | (2.82)  |
| \Delta New_Death_Qin5 | 0.008   | 0.003   | -0.004  | -0.005  |
|                | (0.53)  | (0.19)  | (-0.26) | (-0.30) |
| \Delta New_Case_Qin5 | 0.113*** | 0.109*** | 0.106*** | 0.104*** |
|                | (7.08)  | (6.78)  | (6.64)  | (6.52)  |
| Constant       | 0.174*  | 0.150*  | 0.142   | 0.147*  |
|                | (1.96)  | (1.69)  | (1.60)  | (1.66)  |
| N              | 3494    | 3503    | 3503    | 3503    |
| Industry FE    | YES     | YES     | YES     | YES     |
| Adj. R-squared | 0.05    | 0.05    | 0.05    | 0.05    |

Notes: This table presents estimated results from the OLS regression of CAR[0,1] (panel A) and CAR[2,55] (panel B) on the interaction between \( UE \) and alternative abnormal mobility measures and controls with industry fixed effects. \( UE \) is the earnings surprise, ranked from one to five according to FOM, the fraction of net misses in analyst forecasts as defined in Eq. (1). \( Abn\text{-Residential} \) is the difference between Residential mobility and the median Residential mobility across all counties for a given day, then averaged over the 3-day window before a company’s earnings announcement. \( Residential\text{Dum} \) is a dummy variable that takes the value of one if Residential mobility is higher than the county median over the sample period, and zero otherwise. \( Lockdown\text{Dum} \) is a dummy variable that takes the value of one if the county is under a lockdown restriction for at least 1 day during a short-term pre-announcement window \([-3, -1]\), and zero otherwise. \( Lockdown\text{Count} \) is the number of days in the pre-announcement window that fall within a short-term pre-announcement window \([-3, -1]\). Definitions for all variables (including controls) are available in Appendix Table A. The sample is winsorized at 1% and 99%. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

Table 5

Investor attention and mobility.

|                | (1)     | (2)     | (3)     | (4)     |
|----------------|---------|---------|---------|---------|
| Nonresidential | 0.093** | 0.159* | -0.252*** | 0.435*** |
|                | (2.31)  | (-1.90) | (-6.10) | (5.23)  |
| Residential    | 0.016*** | 0.015*** | 0.004   | 0.005   |
|                | (3.25)  | (3.11)  | (0.79)  | (1.02)  |
| UE             | 0.018    | -0.019  | -0.047*** | -0.044*** |
|                | (-1.23) | (-1.23) | (-3.62) | (-3.34) |
| BTM            | -0.014   | -0.014  | -0.063  | -0.059  |
|                | (-0.37) | (-0.36) | (-1.44) | (-1.33) |
| ROA            | -0.025   | -0.027  | 0.021   | 0.024   |
|                | (-0.82) | (-0.87) | (0.60)  | (0.68)  |
| Ln_Size        | 0.014*** | 0.015*** | 0.086*** | 0.087*** |
|                | (2.61)  | (2.78)  | (15.64) | (15.58) |
| Volume         | 0.015*** | 0.015*** | 0.031*** | 0.031*** |
|                | (6.85)  | (6.72)  | (13.96) | (13.62) |
| \Delta New_Death_Qin5 | -0.059*** | -0.063*** | -0.011  | -0.011  |
|                | (-2.70) | (-2.87) | (-0.53) | (-0.50) |
| \Delta New_Case_Qin5 | -0.007*** | -0.007*** | 0.007*** | 0.007*** |
|                | (-3.38) | (-3.65) | (3.58)  | (3.76)  |
| Constant       | -0.153   | -0.157  | -0.550*** | -0.560*** |
|                | (-0.89) | (-0.91) | (-5.85) | (-5.92) |
| N              | 1177     | 1160    | 2227    | 2181    |
| Industry FE    | YES      | YES     | YES     | YES     |
| Adj. R-squared | 0.23     | 0.24    | 0.35    | 0.35    |

Notes: This table presents estimated results from the OLS regression of institutional attention (AIA) and retail attention (Wiki_Dum) on abnormal mobility measures and controls with industry fixed effects. AIA is a dummy variable that takes the value of one if the average readership score over a 10-day window \([-10, -1]\) is between 3 and 4, and zero otherwise. Wiki_Dum is a dummy variable that takes the value of one if the company’s number of Wikipedia page views over a 10-day window \([-10, -1]\) is in the top quintile of page views, and zero otherwise. Nonresidential is the average of four county-level abnormal mobility measures, for retail and recreation locations, grocery stores and pharmacies, transit stations, and workplaces, averaged over 10 days before the earnings announcement. Residential is abnormal residential mobility, averaged over 10 days before the earnings announcement. \( UE \) is the earnings surprise, ranked from one to five according to FOM, the fraction of net misses in analyst forecasts. The definitions of all variables (including controls) are provided in Appendix Table A. The sample is winsorized at 1% and 99%. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.
Table 6
Investor attention and firm characteristics.

Panel A: Nonresidential mobility

|                | (1)        | (2)        | (3)        | (4)        | (5)        | (6)        |
|----------------|------------|------------|------------|------------|------------|------------|
|                 | AIA        | AIA        | AIA        | Wiki Dum   | Wiki Dum   | Wiki Dum   |
| Nonresidential  | −0.003     | −0.025     | −0.082     | −0.071     | −0.140**   | −0.195***  |
|                 | (−0.06)    | (−0.34)    | (−1.40)    | (−1.03)    | (−1.98)    | (−3.05)    |
| Size_Dum        | 0.180**    |            |            | −0.247**   |            |            |
|                 | (2.48)     |            |            | (−3.11)    |            |            |
| Size_Dum × Nonresidential | 0.070**   | 0.070**    |            | −0.170**   | 0.089***   |            |
|                 | (1.96)     | (1.96)     |            | (−4.71)    | (15.79)    |            |
| Ownership_Dum   | 0.036      |            |            |            |            | −0.045     |
|                 | (1.06)     |            |            |            |            | (−1.40)    |
| Ownership_Dum × Nonresidential | 0.162**   |            |            | −0.156*    |            |            |
|                 | (2.02)     |            |            | (−1.93)    |            |            |
| UE              | 0.014***   | 0.016***   | 0.014***   | 0.005      | 0.005      | 0.006      |
|                 | (2.97)     | (3.20)     | (2.91)     | (0.99)     | (0.96)     | (1.18)     |
| BTM             | −0.019     | −0.020     | −0.015     | −0.041***  | −0.046***  | −0.045***  |
|                 | (−1.24)    | (−1.30)    | (−1.00)    | (−3.35)    | (−3.41)    |            |
| ROA             | −0.009     | −0.007     | −0.011     | −0.072     | −0.064     | −0.054     |
|                 | (−0.23)    | (−0.19)    | (−0.29)    | (−1.62)    | (−1.42)    | (−1.20)    |
| Leverage        | −0.026     | −0.051     | −0.019     | 0.036      | 0.022      |            |
|                 | (−0.83)    | (−0.98)    | (−0.62)    | (1.02)     | (0.63)     | (0.62)     |
| Ln_Size         | 0.013*     | 0.017***   | 0.012**    | 0.106***   | 0.086***   | 0.089***   |
|                 | (1.69)     | (2.83)     | (2.12)     | (13.54)    | (13.85)    | (15.69)    |
| Volume          | 0.015***   | 0.015***   | 0.015***   | 0.029***   | 0.031***   | 0.030***   |
|                 | (6.83)     | (6.84)     | (6.78)     | (12.69)    | (13.53)    | (12.96)    |
| ΔNew_Dead_Qin5  | −0.065***  | −0.063***  | −0.063***  | −0.012     | −0.009     | −0.011     |
|                 | (−3.49)    | (−3.61)    | (−3.46)    | (3.55)     | (3.81)     | (3.70)     |
| ΔNew_Case_Qin5  | −0.007***  | −0.007***  | −0.007***  | 0.007***   | 0.007***   | 0.007***   |
|                 | (−2.93)    | (−2.85)    | (−2.48)    | (−0.53)    | (−0.41)    | (−0.49)    |
| Constant        | −0.167     | −0.186     | −0.199     | −0.670***  | −0.547***  | −0.570***  |
|                 | (−0.96)    | (−1.07)    | (−1.16)    | (−6.68)    | (−5.72)    | (−6.02)    |
| N               | 1160       | 1160       | 1160       | 2181       | 2181       | 2181       |
| Industry FE     | YES        | YES        | YES        | YES        | YES        | YES        |
| Adj. R-squared  | 0.24       | 0.24       | 0.25       | 0.36       | 0.35       | 0.36       |

Panel B: Residential mobility

|                | (1)        | (2)        | (3)        | (4)        | (5)        | (6)        |
|----------------|------------|------------|------------|------------|------------|------------|
|                 | AIA        | AIA        | AIA        | Wiki Dum   | Wiki Dum   | Wiki Dum   |
| Residential     | 0.036      | 0.034      | 0.199      | 0.101      | 0.281*     | 0.288**    |
|                 | (0.32)     | (0.23)     | (1.63)     | (0.73)     | (1.93)     | (2.24)     |
| Size_Dum        | 0.080**    |            |            | −0.176**   |            |            |
|                 | (2.08)     |            |            | (−4.67)    |            |            |
| Size_Dum × Residential | −0.382** | −0.382**   |            | 0.462***   |            |            |
|                 | (−2.53)    | (−2.53)    |            | (2.88)     |            |            |
| Num_Analysts    | 0.030      |            |            |            | −0.033     |            |
|                 | (0.82)     |            |            |            | (−0.96)    |            |
| Num_Analysts × Residential | −0.273*  |            |            | 0.215      |            |            |
|                 | (−1.66)    |            |            | (1.30)     |            |            |
| Ownership_Dum   | 0.133***   |            |            |            |            | −0.073**   |
|                 | (4.02)     |            |            |            |            | (−2.32)    |
| Ownership_Dum × Residential | −0.591*** |            |            | 0.222      |            |            |
|                 | (−3.94)    |            |            | (1.43)     |            |            |
| UE              | 0.015***   | 0.016***   | 0.014***   | 0.004      | 0.004      | 0.005      |
|                 | (3.09)     | (3.32)     | (3.01)     | (0.78)     | (0.77)     | (1.00)     |
| BTM             | −0.019     | −0.021     | −0.015     | −0.044***  | −0.047***  | −0.048***  |
|                 | (−1.28)    | (−1.36)    | (−1.02)    | (−3.39)    | (−3.54)    | (−3.72)    |
| ROA             | −0.010     | −0.009     | −0.012     | −0.075*    | −0.066     | −0.059     |
|                 | (−0.26)    | (−0.24)    | (−0.33)    | (−1.72)    | (−1.50)    | (−1.34)    |
| Leverage        | −0.024     | −0.028     | −0.016     | 0.033      | 0.019      | 0.017      |
|                 | (−0.78)    | (−0.92)    | (−0.53)    | (0.95)     | (0.55)     | (0.50)     |
| Ln_Size         | 0.012      | 0.016***   | 0.015**    | 0.106***   | 0.085***   | 0.089***   |
|                 | (1.61)     | (2.73)     | (1.96)     | (13.75)    | (13.89)    | (15.79)    |

(continued on next page)
Table 6 (continued)

| Panel B: Residential mobility | (1) | (2) | (3) | (4) | (5) | (6) |
|------------------------------|-----|-----|-----|-----|-----|-----|
|                              | AIA | AIA | AIA | Wiki_Dum | Wiki_Dum | Wiki_Dum |
| **Volume**                   | 0.015*** | 0.015*** | 0.015*** | 0.030*** | 0.031*** | 0.030*** |
|                             | (6.93) | (6.96) | (6.93) | (13.03) | (13.87) | (13.28) |
| ΔNew_Death_Qin5              | −0.059*** | −0.058*** | −0.058*** | −0.012 | −0.011 | −0.012 |
|                             | (−2.74) | (−2.67) | (−2.68) | (−0.57) | (−0.48) | (−0.53) |
| ΔNew_Case_Qin5              | −0.006*** | −0.007*** | −0.006*** | 0.006*** | 0.007*** | 0.007*** |
|                             | (−3.22) | (−3.36) | (−3.22) | (3.34) | (3.58) | (3.51) |
| **Constant**                 | −0.168 | −0.179 | −0.204 | −0.665*** | −0.540*** | −0.560*** |
|                             | (−0.96) | (−1.04) | (−1.19) | (−6.68) | (−5.68) | (−5.95) |
| **N**                       | 1177 | 1177 | 1177 | 2227 | 2227 | 2227 |
| **Industry FE**             | YES | YES | YES | YES | YES | YES |
| **Adj. R-squared**          | 0.24 | 0.24 | 0.24 | 0.36 | 0.35 | 0.35 |

Notes: This table presents estimated results from the OLS regression of institutional attention (AIA) and retail attention (Wiki_Dum) on Nonresidential mobility (panel A) and Residential mobility (panel B), interacting with company size, analysts following, and institutional ownership. Size_Dum is a dummy variable that takes the value of one if the firm size is greater than the median firm size in our sample, and zero otherwise. Ownership_Dum is a dummy variable that takes the value of one if a given firm has an institutional ownership above that of the median firm in our sample, and zero otherwise. Nonresidential is the average of four county-level abnormal mobility measures, for retail and recreation locations, grocery stores and pharmacies, transit stations, and workplaces, averaged over 10 days before the earnings announcement. Residential is abnormal residential mobility, averaged over 10 days before the earnings announcement. UE is the earnings surprise, ranked from one to five according to FOM, the fraction of net misses in analyst forecasts as defined in Eq. (1). The definitions of all variables (including controls) are provided in Appendix Table A. The sample is winsorized at 1% and 99%, ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

5. Robustness tests

5.1. Investor attention and firm characteristics

If institutional attention is a mechanism for the relationship between mobility and information diffusion, then firms whose information diffusion relies more on institutional attention in normal times should suffer more from earnings underreaction when nonresidential mobility decreases. In Table 6 panel A, we augment the model in Table 5 with an interaction term between Nonresidential mobility and a firm characteristic that proxies for greater reliance on institutional attention. In panel B we repeat the same analysis replacing Nonresidential with Residential mobility. Ben-Rephael et al. (2017) find that larger firms and stocks with greater analyst coverage tend to experience more shocks in institutional attention, after news-related variables are controlled. Since they find an insignificant relationship between institutional ownership and institutional attention in their sample, we adopt three different dummy variables to proxy for firms’ dependence on institutional attention using firm size, analyst coverage and institutional ownership. Size_Dum takes the value of one if the firm size is greater than the median firm size in our sample, and zero otherwise. Num_Analysts takes the value of one if the number of analysts following the firm is greater than the median value in the sample, and zero otherwise. Ownership_Dum takes the value of one if the firm has institutional ownership above the median value in our sample, and zero otherwise.

We find positive coefficients on the interaction between Nonresidential and each of these three proxies in Panel A, suggesting that a drop in face-to-face interaction is associated with a larger drop in institutional attention for larger firms, firms with more analysts following, and firms with larger institutional ownership. Predictably, the interaction terms with Residential in panel B have opposite signs. Taken together, these results further strengthen the positive association between face-to-face interaction and institutional investor intention.

For retail attention we find contrasting results: in columns 4–6 of panel A, we find negative and statistically significant coefficients on the interactions between Nonresidential and Size_Dum, and between Nonresidential and Num_Analysts. This suggests that as individual traders spend less time at home, they pay relatively less attention to large firms and firms with more analysts following. This is supported by the opposite signs in the interaction terms with Residential in panel B.

The more a firm relies on institutional attention, the more the reduction in face-to-face interaction should adversely affect market response to its earnings news, both immediately and in subsequent periods. We augment Model (4) for all three estimation windows with a three-way interaction term among UE, Mobility, and a firm characteristics variable that proxy for greater reliance on institutional attention. Panels A and B in Table 7 show our results for CAR[0,1] and CAR[2,55], respectively, in the 3-day window [−3, −1] for abnormal mobility measures. The specifications in both panels are the same. Column 1 (2) employs the three-way interaction term among UE, Nonresidential (Residential), and Size_Dum. Using the same specification, columns 3 and 4 replace Size_Dum in the 3-way

---

12 The results were insignificant for analyst coverage.

13 Results are similar when we re-estimate the model using the other two estimation windows ([−5, −1] and [−10, −1]) for abnormal mobility measures.
Table 7
Institutional ownership and market reaction.

### Panel A: CAR[0,1]

|                  | (1)        | (2)        | (3)        | (4)        |
|------------------|------------|------------|------------|------------|
|                  | Nonresidential | Residential | Nonresidential | Residential |
| **UE**           | 0.019***  (9.11) | 0.018***  (8.41) | 0.019***  (9.05) | 0.018***  (8.34) |
| **Ownership_Dum**| 0.005      (0.78) | 0.004      (0.58) | 0.005      (0.78) | 0.004      (0.58) |
| **Nonresidential**| −0.110***  (−5.39) | −0.110***  (−5.38) | 0.224***  (5.37) | 0.223***  (5.35) |
| **Residential**  | 0.016***  (2.63) | 0.023***  (3.81) | 0.016***  (2.58) | 0.022***  (3.72) |
| **UE × Nonresidential** | 0.000      (0.03) | 0.000      (0.03) | 0.000      (0.03) | 0.000      (0.03) |
| **UE × Residential** | 0.062**  (2.50) | 0.065***  (2.59) | 0.062**  (2.40) | 0.065***  (2.59) |
| **BTM**          | 0.012***  (3.59) | 0.011***  (3.37) | 0.012***  (3.66) | 0.011***  (3.43) |
| **Leverage**     | 0.015*  (1.78) | 0.016*  (1.96) | 0.015*  (1.86) | 0.016*  (1.96) |
| **Ln_Size**      | −0.001     (−0.72) | −0.002     (−0.80) | −0.001     (−0.75) | −0.001     (−0.70) |
| **Volume**       | 0.000      (0.54) | 0.000      (0.60) | 0.000      (0.38) | 0.000      (0.38) |
| **ΔNew_Death_Qin5** | −0.014*** (−2.68) | −0.015*** (−2.97) | −0.014*** (−2.66) | −0.015*** (−2.96) |
| **ΔNew_Case_Qin5** | −0.020*** (−3.83) | −0.022*** (−4.20) | −0.021*** (−3.95) | −0.023*** (−4.35) |
| **Constant**     | −0.100*** (−3.48) | −0.102*** (−3.48) | −0.102*** (−3.69) | −0.103*** (−3.74) |
| **N**            | 3429       | 3494       | 3429       | 3494       |
| **Industry FE**  | YES        | YES        | YES        | YES        |
| **Adj. R-squared** | 0.05      | 0.05       | 0.05       | 0.05       |

### Panel B: CAR[2,55]

|                  | (1)        | (2)        | (3)        | (4)        |
|------------------|------------|------------|------------|------------|
|                  | Nonresidential | Residential | Nonresidential | Residential |
| **UE**           | 0.003      (0.39) | 0.000      (0.03) | 0.002      (0.34) | −0.000     (−0.01) |
| **Ownership_Dum**| 0.062**  (2.50) | 0.065***  (2.59) | 0.013      (0.66) | 0.018      (0.89) |
| **Nonresidential**| 0.209***  (3.15) | 0.475***  (3.51) | 0.205***  (3.08) | −0.469***  (−3.46) |
| **Residential**  | −0.030     (−1.55) | −0.060*** (−3.03) | −0.030     (−1.55) | −0.060*** (−3.03) |
| **UE × Nonresidential** | 0.000      (0.00) | 0.000      (0.00) | 0.000      (0.00) | 0.000      (0.00) |
| **UE × Residential × Size_Dum** | 0.000      (0.00) | 0.000      (0.00) | 0.000      (0.00) | 0.000      (0.00) |

(continued on next page)
In column 1 of panel A, we find a positive coefficient on both the two-way and three-way interaction terms, suggesting that an increase in Nonresidential mobility increases CAR\([0,1]\) and that the effect is stronger for large firms. Similar findings emerge in column 3 when we repeat the same analysis replacing Size_Dum with Ownership_Dum. These results again suggest that decreased face-to-face interaction mutes the immediate market response to earnings news more pronouncedly for firms that depend more on institutional attention.

As we expected, we find a negative coefficient on the 3-way interaction term in columns 2 and 4. In panel B of Table 7, we investigate whether reduced face-to-face interaction increases post-announcement drift more in firms that depend more on institutional attention. The results show a negative (positive) coefficient on the three-way interaction terms in columns 1 and 3 (2 and 4), suggesting that the larger drift associated with reduced face-to-face interaction is exacerbated in firms that get more institutional attention (i.e., larger firms and firms with greater institutional ownership).

In sum, our results strongly support the notion that face-to-face interaction affects information dissemination and price reactions around earnings announcements, and that it does so through institutional attention.

### 5.2. High vs. low abnormal nonresidential mobility

Since some states imposed lockdown restrictions sooner and more stringently than others, abnormal mobility varies considerably over time and across counties (see Fig. 1). If our main hypothesis is supported, we should observe the strongest price underreactions...
5.3. Separate categories of abnormal nonresidential mobility

What happens if we separate Nonresidential mobility into its four components, abnormal mobility at retail and recreation locations, grocery stores and pharmacies, transit stations, and workplaces? We re-run the regressions in Model (4) with each of the four specific measures and present the results for CAR[0,1] and CAR[2,55] in Table 9 panels A and B, respectively.

In the regressions for CAR[0,1] the coefficients on all four categories of nonresidential mobility have a positive sign, confirming the baseline regression results; and in the regressions for CAR[2,55], the analogous coefficients are negative. We conclude that the impact of abnormal nonresidential mobility (as a proxy for face-to-face interaction) on the market response to earnings news is quantitatively similar regardless of the mobility measure used.

5.4. Retail investors and information dissemination

If face-to-face interactions affect the information dissemination process through the channel of institutional investor attention, do they also affect it through retail investor attention? According to classic information theory, retail investors are noisy traders and their

Table 8
Comparison between high and low mobility.

|                | (1) CAR(0,1) | (2) CAR(0,1) | (3) CAR[2,55] | (4) CAR[2,55] |
|----------------|--------------|--------------|---------------|---------------|
| UE            | 0.015***     | 0.010***     | 0.021***      | 0.024***      |
| (10.31)       | (7.05)       | (4.34)       | (5.25)        |               |
| Mob_low       | 0.024***     |              | -0.018        |               |
| (2.72)        |              | (-0.63)      |               |               |
| UE × Mob_low  | -0.007***    | -0.012       |               |               |
| (-2.68)       | (-1.46)      |              |               |               |
| Mob_hi        | -0.055***    |              | 0.089***      |               |
|               | (-5.86)      |              | (2.91)        |               |
| UE × Mob_hi   | 0.010***     |              | -0.026***     |               |
|               | (4.90)       |              | (-3.12)       |               |
| BTM           | 0.011***     | 0.010***     | 0.037***      | 0.042***      |
| (3.29)        | (3.23)       | (3.53)       | (3.98)        |               |
| ROA           | 0.019***     | 0.019***     | 0.072***      | 0.083***      |
| (2.65)        | (2.65)       | (3.09)       | (3.58)        |               |
| Leverage      | 0.013        | 0.014*       | 0.103***      | 0.122***      |
| (1.51)        | (1.69)       | (3.81)       | (4.55)        |               |
| Ln_Size       | -0.001       | -0.001       | -0.019***     | -0.019***     |
| (-1.14)       | (-0.79)      | (-4.40)      | (-4.54)       |               |
| Volume        | 0.001        | 0.001        | 0.006***      | 0.006***      |
| (0.88)        | (0.64)       | (2.93)       | (2.99)        |               |
| ΔNew_Death_Qin5 | -0.006        | -0.013***    | 0.014        | 0.002         |
| (1.25)        | (-2.64)      | (0.90)       | (0.10)        |               |
| ΔNew_Case_Qin5 | -0.015***    | -0.022***    | 0.116***      | 0.106***      |
| (3.05)        | (-4.16)      | (7.29)       | (6.21)        |               |
| Constant      | -0.085***    | -0.047*      | 0.141        | 0.086         |
| (-3.11)       | (-1.68)      | (1.60)       | (0.96)        |               |
| N             | 3503         | 3503         | 3503          | 3503          |
| Industry FE   | YES          | YES          | YES           | YES           |
| Adj. R-squared | 0.05          | 0.06         | 0.06         | 0.05          |

Notes: This table presents estimated results from the OLS regression of CAR[0,1] (panel A) and CAR[2,55] (panel B) on the interaction between UE and dummy variables (Mob_low and Mob_hi) and controls with industry fixed effects. UE is the earnings surprise, ranked from one to five according to FOM, the fraction of net misses in analyst forecasts as defined in Eq. (1). The definitions of all variables (including controls) are provided in Appendix Table A. The sample is winsorized at 1% and 99%. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.
Table 9

Breaking down nonresidential mobility into four categories.

Panel A: $\text{CAR}[0,1]$

|                | (1)                  | (2)                  | (4)                  | (5)                  |
|----------------|----------------------|----------------------|----------------------|----------------------|
| $\text{UE}$   | 0.017*** (9.26)      | 0.016*** (10.91)     | 0.019*** (9.42)      | 0.018*** (8.12)      |
| $\text{Ret} \& \text{Rec}$ | $-0.099^{***}$ (−5.08) |                      |                      |                      |
| $\text{UE} \times \text{Ret} \& \text{Rec}$ | 0.015*** (3.08)     |                      |                      |                      |
| $\text{Gro} \& \text{Phar}$ |                      | $-0.160^{***}$ (−4.81) |                      |                      |
| $\text{UE} \times \text{Gro} \& \text{Phar}$ | 0.037*** (3.94)     |                      |                      |                      |
| $\text{Transits}$ |                      |                      | −0.083*** (−5.33)   |                      |
| $\text{UE} \times \text{Transits}$ | 0.016*** (3.76)     |                      |                      |                      |
| $\text{Workplaces}$ |                      |                      | −0.091*** (−5.21)  |                      |
| $\text{UE} \times \text{Workplaces}$ |                      |                      | 0.013*** (2.61)     |                      |
| $\text{BTM}$  | 0.011*** (3.52)      | 0.011*** (3.44)      | 0.012*** (3.60)      | 0.011*** (3.39)      |
| $\text{ROA}$  | 0.021*** (3.00)      | 0.020*** (2.77)      | 0.020*** (2.78)      | 0.021*** (2.93)      |
| $\text{Leverage}$ | 0.017** (1.99)      | 0.014* (1.73)        | 0.014* (1.68)        | 0.016** (1.97)       |
| $\text{Ln}_\text{Size}$ | $-0.001$ (−1.04)   | $-0.001$ (−0.99)     | $-0.001$ (−0.77)     | $-0.001$ (−1.05)     |
| $\text{Volume}$ | 0.000 (0.59)        | 0.000 (0.64)         | 0.000 (0.45)         | 0.000 (0.60)         |
| $\Delta \text{New,Death, Qin5}$ | $-0.012^{**}$ (−2.48) | $-0.009^{*}$ (−1.84) | $-0.012^{**}$ (−2.35) | $-0.016^{***}$ (−3.12) |
| $\Delta \text{New, Case, Qin5}$ | $-0.021^{***}$ (−4.00) | $-0.017^{***}$ (−3.35) | $-0.019^{***}$ (−3.74) | $-0.023^{***}$ (−4.52) |
| $\text{Constant}$ | $-0.094^{***}$ (−3.44) | $-0.096^{***}$ (−3.48) | $-0.102^{***}$ (−3.71) | $-0.097^{***}$ (−3.55) |
| $\text{N}$    | 3497                 | 3493                 | 3429                 | 3503                 |
| $\text{Industry FE}$ | YES                 | YES                 | YES                 | YES                 |
| $\text{Adj. R-squared}$ | 0.05                 | 0.05                 | 0.05                 | 0.05                 |

Panel B: $\text{CAR}[2,55]$

|                | (1)                  | (2)                  | (4)                  | (5)                  |
|----------------|----------------------|----------------------|----------------------|----------------------|
| $\text{UE}$   | 0.008 (1.30)         | 0.015*** (2.98)      | −0.001 (−0.22)       | 0.003 (0.47)         |
| $\text{Ret} \& \text{Rec}$ | 0.142** (2.47)     |                      |                      |                      |
| $\text{UE} \times \text{Ret} \& \text{Rec}$ | $-0.028^{*}$ (−1.77) |                      |                      |                      |
| $\text{Gro} \& \text{Phar}$ |                      | 0.220** (2.04)      |                      |                      |
| $\text{UE} \times \text{Gro} \& \text{Phar}$ | $-0.018$ (−0.59)   |                      |                      |                      |
| $\text{Transits}$ |                      |                      | 0.163*** (3.19)     |                      |
| $\text{UE} \times \text{Transits}$ | −0.044*** (−3.14)  |                      |                      |                      |
| $\text{Workplaces}$ |                      |                      | 0.185*** (3.25)     | −0.033** (−2.10)     |
| $\text{UE} \times \text{Workplaces}$ |                      |                      | −0.040*** (−2.10)  |                      |
| $\text{BTM}$  | 0.039*** (3.74)      | 0.038*** (3.63)      | 0.040*** (3.74)      | 0.040*** (3.78)      |
| $\text{ROA}$  | 0.079*** (3.42)      | 0.075*** (3.24)      | 0.083*** (3.55)      | 0.079*** (3.41)      |
| $\text{Leverage}$ | 0.115*** (4.27)      | 0.112*** (4.16)      | 0.119*** (4.34)      | 0.115*** (4.28)      |
| $\text{Ln}_\text{Size}$ | $-0.019^{**}$ (−4.28) | $-0.018^{**}$ (−4.28) | $-0.019^{***}$ (−4.28) |                      |

(continued on next page)
Table 9 (continued)

Panel B: CAR[2,55]

|               | (1)                | (2)                | (3)                | (4)                | (5)                |
|---------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|               |                |                    |                    |                    |                    |
| Volume        | 0.006*** (2.99)   | 0.006*** (2.83)    | 0.006*** (2.96)    | 0.006*** (3.02)    |
| ΔNew_Death_Qin5 | 0.09 (0.54)      | 0.14 (0.85)       | 0.04 (0.23)        | 0.016 (0.99)       |
| ΔNew_Case_Qin5 | 0.115*** (6.91)   | 0.122*** (7.40)   | 0.111*** (6.59)    | 0.120*** (7.18)    |
| Constant      | 0.164* (1.85)     | 0.159* (1.78)     | 0.184** (2.05)     | 0.176** (1.98)     |
|               | 0.115*** (6.91)   | 0.122*** (7.40)   | 0.111*** (6.59)    | 0.120*** (7.18)    |
|               | 0.164* (1.85)     | 0.159* (1.78)     | 0.184** (2.05)     | 0.176** (1.98)     |
|               | 0.115*** (6.91)   | 0.122*** (7.40)   | 0.111*** (6.59)    | 0.120*** (7.18)    |
|               | 0.164* (1.85)     | 0.159* (1.78)     | 0.184** (2.05)     | 0.176** (1.98)     |
|               | 0.115*** (6.91)   | 0.122*** (7.40)   | 0.111*** (6.59)    | 0.120*** (7.18)    |
| N             | 3497             | 3493             | 3429             | 3494             |
| Industry FE   | YES             | YES             | YES             | YES             |
| Adj. R-squared | 0.05          | 0.05            | 0.05            | 0.05            |

Notes: This table presents estimated results from the OLS regression (Model (4) of CAR[0,1] (panel A) and CAR[2,55] (panel B) on the interaction between UE and mobility measures and controls with industry fixed effects. UE is the earnings surprise, ranked from one to five according to FOM, the fraction of net misses in analyst forecasts as defined in Eq. (1). The four categories of county-level abnormal mobility measures include retail and recreation locations (Ret&Rec), grocery stores and pharmacies (Groc&Phar), transit stations (Transits), and workplaces. Residential is abnormal residential mobility. All mobility measures are computed as the average over a 3-day [−3,−1] window before the earnings announcement. The definitions of all variables (including controls) are provided in Appendix Table A. The sample is winsorized at 1% and 99%. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

Table 10
Retail ownership and market reaction.

|               | (1)                | (2)                | (3)                | (4)                |
|---------------|--------------------|--------------------|--------------------|--------------------|
|               | CAR[0,1]           | CAR[0,1]           | CAR[2,55]          | CAR[2,55]          |
| UE            | 0.019*** (9.15)    | 0.018*** (8.41)    | 0.002 (0.37)       | 0.000 (0.06)       |
| RetO_Dum      | 0.004 (−0.60)      | 0.005 (−0.71)      | 0.017 (−0.76)      | 0.018 (−0.81)      |
| Nonresidential| 0.111*** (−5.43)   | 0.204*** (3.07)    |                   |                   |
| UE × Nonresidential | 0.019*** (3.36) |                   | −0.042** (−2.26)   |                   |
| UE × Residential × RetO_Dum | 0.001 (0.12) | 0.002 (−0.10) |                   |                   |
| Residential   | 0.225*** (5.39)    |                   | −0.466*** (−3.44)  |                   |
| UE × Residential | −0.034*** (−2.96) |                   | 0.094*** (2.49)    |                   |
| UE × Residential × RetO_Dum | −0.001 (−0.13) |                   | 0.009 (0.28)       |                   |
| BTM           | 0.012*** (3.74)    | 0.012*** (3.53)    | 0.040*** (3.69)    | 0.040*** (3.82)    |
| ROA           | 0.020*** (2.70)    | 0.020*** (2.73)    | 0.080*** (3.37)    | 0.076*** (3.27)    |
| Leverage      | 0.016* (1.87)      | 0.017** (2.08)     | 0.116*** (4.21)    | 0.116*** (4.29)    |
| Ln_Size       | −0.002 (−1.16)     | −0.002 (−1.20)     | −0.021*** (−4.50)  | −0.021*** (−4.50)  |
| Volume        | 0.000 (0.64)       | 0.000 (0.75)       | 0.007*** (3.13)    | 0.007*** (3.13)    |
| ΔNew_Death_Qin5| −0.014*** (−2.71) | −0.015*** (−3.02) | 0.011 (0.63)       | 0.012 (0.75)       |
| ΔNew_Case_Qin5| −0.021*** (−3.99)  | −0.023*** (−4.37)  | 0.119*** (6.96)    | 0.119*** (7.03)    |
| Constant      | −0.095*** (−3.31)  | −0.095*** (−3.30)  | 0.202** (2.17)     | 0.208** (2.23)     |
|               |                  |                  |                  |                  |
| N             | 3429             | 3494             | 3429             | 3494             |
| Industry FE   | YES             | YES             | YES             | YES             |
| Adj. R-squared | 0.06          | 0.06            | 0.05            | 0.05            |

Notes: This table presents estimated results from the OLS regression of CAR[0,1] (panel A) and CAR[2,55] (panel B) on the three-way interaction among UE, mobility measures, and RetO_Dum, controlling for industry fixed effects. UE is the earnings surprise, ranked from one to five according to FOM, the fraction of net misses in analyst forecasts as defined in Eq. (1). RetO_Dum, is a dummy variable coded one if the proportion of retail ownership of the firm belongs in the top one-third of the sample, and zero otherwise. Nonresidential is the average of four county-level abnormal mobility measures, for retail and recreation locations, grocery stores and pharmacies, transit stations, and workplaces, averaged over 10 days before the earnings announcement. Residential is abnormal residential mobility, averaged over 10 days before the earnings announcement. The definitions of all variables (including controls) are provided in Appendix Table A. The sample is winsorized at 1% and 99%. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.
role is to provide liquidity to informed traders; they have no meaningful impact on price discovery (Kyle, 1985). Therefore, we expect them to have minimal influence on how mobility affects information dissemination around earnings announcements. We test this conjecture using retail ownership as a proxy for retail investing. We first identify firms that have the highest retail ownership by defining a dummy variable, RetO_Dum, coded one if the proportion of retail ownership of the firm belongs in the top one-third of the sample, and zero otherwise. We then augment Model (4) with a three-way interaction term among RetO_Dum, UE, and each of the abnormal mobility measures, Nonresidential and Residential.

The first two columns in Table 10 present estimated results for CAR(0,1]. The coefficients on the three-way interaction terms with both Nonresidential and Residential are statistically insignificant. Similar findings appear in the three-way interaction terms for CAR[2,5] in columns 3 and 4. This suggests that the level of retail ownership does not affect information diffusion in the stock market.

6. Conclusion

The proliferation of technology enabling virtual communication, such as social media platforms, may have made face-to-face interaction obsolete. But are telecommunications alone enough to facilitate efficient financial markets? Our COVID-19 event study shows that firms located in counties with lower human mobility experience a less sensitive immediate price reaction to earnings announcements and a stronger post-earnings announcement drift. These findings support our hypothesis that reduced face-to-face interaction does indeed impede information flow. The findings are robust to several alternative measures of abnormal mobility, including the effective and lifting dates of stay-at-home restrictions published by state governors. We also find that this effect works principally through institutional investor attention; firms that rely more on such attention suffer more from price underreaction exacerbated by restrictions on face-to-face interactions during COVID-19. But our study goes beyond the growing literature on the pandemic’s impact on financial markets, to demonstrate the general importance of human face-to-face interactions in those markets, contributing to the ongoing debate on how far telecommunications should substitute for face-to-face interactions.

Conflicts of interest statement

The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers’ bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Appendix Table A

| Name            | Definition                                                                                     |
|-----------------|------------------------------------------------------------------------------------------------|
| CAR             | Cumulative abnormal returns computed from daily abnormal returns according to the Fama-French-Carhart four-factor model over an estimation window of [−120, −21] days. |
| Residential_Dum | A dummy variable that takes the value of one if Residential mobility is higher than the county median mobility over the sample period, and zero otherwise. |
| Nonresidential_Dum | A dummy variable that takes the value of one if Nonresidential mobility is higher than the county median mobility over the sample period, and zero otherwise. |
| Lockdown_Dum    | A dummy variable that takes the value of one if the county is under a lockdown restriction for at least 1 day during a short-term pre-announcement window [−3, −1], and zero otherwise. |
| Lockdown_Count  | The number of lockdown days in the pre-announcement period that falls within a short-term pre-announcement window [−3, −1]. |
| Mob_hi          | A dummy variable coded one for the top tercile (i.e., highest abnormal nonresidential mobility) and zero for the rest of the sample. |
| FOM             | Calculated as (K – M)/N, where N is the total number of analyst forecasts for a given quarter, K is the number of forecasts that are lower than the actual earnings, or misses; and M is the number of forecasts that are higher than the actual earnings, or overshoots. Ranging between one and minus one, it measures the fraction of net misses in all analyst forecasts. |
| UE              | Abnormal institutional attention proxied by Bloomberg’s average readership score takes a value between 0 and 4 and is taken around the earnings announcement in a 10-day estimation window [−10, −1]. AIA is a dummy variable that takes the value of one if the average readership score over the estimation window is between 3 and 4, and zero otherwise. |
| Wiki_Dum        | A dummy variable that takes the value of one if the company’s number of Wikipedia page views over a 10-day window [−10, −1] is in the top quintile of page views, and zero otherwise. |
| BTM             | The book-to-market ratio, measured as the book value of common equity divided by market capitalization at last fiscal year end. |
| ROA             | Return on assets, measured as income before extraordinary items divided by total assets at last fiscal year end. |

(continued on next page)
(continued)

| Name                  | Definition                                                                                                                                 |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Leverage              | Leverage level, measured as long-term debt plus short-term debt then divided by book value of total assets at last fiscal year end.          |
| Ln(Size)              | Firm size, measured as the natural logarithm of total assets at last fiscal year end.                                                      |
| Volume                | Average daily trading volume over the pre-announcement window [−3, −1].                                                                     |
| ΔNew,Death,Qin5       | A dummy variable that is coded one if the average daily change in the number of new deaths 10 days before a firm’s earnings announcement is in the top quintile, and zero otherwise. |
| ΔNew,Case,Qin5        | A dummy variable that is coded one if the average daily change in the number of new cases 10 days before a firm’s earnings announcement is in the top quintile, and zero otherwise. |
| Size_Dum              | A dummy variable that takes the value of one if a given firm’s size is greater than the median firm size in our sample, and zero otherwise. |
| Num_Analysts          | A dummy variable that takes the value of one if the number of analysts following a given firm is greater than the median value in the sample, and zero otherwise. |
| Ownership_Dum         | A dummy variable that takes the value of one if a given firm has an institutional ownership above the median value in the sample, and zero otherwise. |
| RetO_Dum              | A dummy variable that takes the value of one if the proportion of retail ownership of the firm belongs in the top one-third of the sample, and zero otherwise. |

References

Ahuja, M. K., Galletta, D. F., & Carley, K. M. (2003). Individual centrality and performance in virtual R&D groups: An empirical study. *Management Science, 49*(1), 21–38.

Albesluces, C. (2020). Coronavirus and financial volatility: 40 days of fasting and fear. *arXiv Preprint, arXiv:2003.04005.*

Baig, A., Butt, H. A., Haroon, O., & Rizvi, S. A. R. (2021). Deaths, panic, lockdowns and US equity markets: The case of COVID-19 pandemic. *Finance Research Letters, 38,* 101701.

Baik, B., Kang, J. K., & Kim, J. M. (2010). Local institutional investors, information asymmetries, and equity returns. *Journal of Financial Economics, 97*(1), 81–106.

Baker, S. R., Bloom, N., & Kost, K. J., Sammon, M. C., & Viratayosin, T. (2020). The unprecedented stock market impact of COVID-19 (No. w26945). National Bureau of Economic Research.

Ball, R., & Brown, P. (1968). A market for corporate control: the case of tender offers. *The Journal of Finance, 23,* 344–368.

Bhagwat, V., & Burch, T. R. (2016). Pump it up? Tweeting to manage investor attention to earnings news. *Journal of Accounting Research, 54*(3), 771–800.

Bhagwat, V., & Burch, T. R. (2016). Pump it up? Tweeting to manage investor attention to earnings news. *Journal of Accounting Research, 54*(3), 771–800.

Bloom, N. (2020). *How working from home works out (Policy Brief June).* Institute for Economic Policy Research (SIEPR).

Brown, N. C., Stice, H., & White, R. M. (2015). Mobile communication and local information flow: Evidence from distracted driving laws. *Journal of Accounting Research, 53*(2), 275–326.

Bushee, B. J., Gerakos, J., & Lee, L. F. (2018). Corporate jets and private meetings with investors. *Journal of Accounting and Economics, 65*(2–3), 358–379.

Bushee, B. J., Jung, M. J., & Miller, G. S. (2011). Conference presentations and the disclosure milieu. *Journal of Accounting Research, 49*(5), 1163–1192.

Chapman, K. (2018). Earnings notifications, investor attention, and the earnings announcement premium. *The Review of Financial Studies, 30*(9), 3009–3047.

Cheema, M. A., Faff, R. W., & Szulczuk, K. (2020). The 2008 global financial crisis and COVID-19 pandemic: How safe are the safe haven assets? *Accounting Review, 59*(4), 574–603.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheema, M. A., Faff, R. W., & Szulczuk, K. (2020). The 2008 global financial crisis and COVID-19 pandemic: How safe are the safe haven assets? *Accounting Review, 59*(4), 574–603.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheema, M. A., Faff, R. W., & Szulczuk, K. (2020). The 2008 global financial crisis and COVID-19 pandemic: How safe are the safe haven assets? *Accounting Review, 59*(4), 574–603.

Cheema, M. A., Faff, R. W., & Szulczuk, K. (2020). The 2008 global financial crisis and COVID-19 pandemic: How safe are the safe haven assets? *Accounting Review, 59*(4), 574–603.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.

Cheng, Q., Du, F., Wang, B. Y., & Wang, X. (2016). Seeing is believing: Analysts’ attention to analysts’ site visits. *Journal of Accounting Research, 54*(1), 1–36.
