# Do Firms Strategically Disseminate?
# Evidence from Corporate Use of Social Media

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**ABSTRACT:** We examine whether firms strategically disseminate information to the public. Strategic dissemination refers to a firm's decision to use or not use certain channels of communication to disseminate firm-specific information. Understanding whether firms strategically disseminate is important because it reveals how managers try to shape a firm's overall information environment, influence how capital market participants view the firm, and affect the price discovery process. Using firms' discretionary use of Twitter to disseminate quarterly earnings announcements, we find that firms are less likely to disseminate via Twitter when the news is bad and when the magnitude of the bad news is worse, consistent with strategic behavior. Furthermore, firms tend to send fewer earnings announcement tweets and "rehash" tweets when the news is bad. Finally, we find evidence that the tweeting of bad news and the subsequent retweeting of that news by a firm's followers are associated with more negative news articles written about the firm by the traditional media, highlighting a potential downside to Twitter dissemination.

JEL classifications: G14, G38, M10, M21, M41

**Keywords:** strategic dissemination; strategic disclosure; social media; Twitter

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## I. INTRODUCTION

We examine whether firms strategically disseminate information to the public. Strategic dissemination refers to a firm's decision to use or not use certain channels of communication to disseminate firm-specific information. Prior studies have examined strategic *disclosure*, in which firms weigh the costs and benefits to revealing their private information (Schrand and Walther 2000; Lougee and Marquardt, 2004; Kothari, Shu, and Wysocki 2009; Hanley and Hoberg, 2012; Niessner 2015), and newswire dissemination, in which firms distribute their disclosures via the business press (Bushee, Core, Guay, and Hamm 2010; Drake, Roulstone, and Thornock 2012; Twedt 2016). The latter studies have established that the dissemination process has important consequences above and beyond the disclosure decision (Li, Ramesh, and Shen, 2011; Twedt 2016). However, strategic dissemination has not be directly documented in prior studies because the difficulty in examining this research question has been that the disclosure and dissemination decisions are usually inseparable (e.g., many disclosures must be disseminated through the SEC EDGAR platform) or the dissemination channel is not controlled by the firm (e.g., the business press makes editorial decisions about which stories to run). Understanding whether firms strategically disseminate is important because it reveals how managers try to shape a firm's overall information environment, influence how capital market participants view the firm, and affect the price discovery process (Lee 2001).

In this paper, we exploit firms' discretionary use of social media to disseminate quarterly earnings announcements to examine whether firms strategically disseminate. We focus on Twitter because we find that its adoption among firms has surpassed other social media platforms such as Facebook, likely because a "tweet" is conducive for frequently communicating various corporate announcements at specific times. Importantly, firms do not have to use Twitter

to disseminate information that has also been disseminated through traditional channels, which allows us to distinguish the dissemination decision from the disclosure decision. We focus on quarterly earnings announcements because they are of first-order importance to investors and because our data reveal that they are the most prevalent type of investor-related announcement disseminated through Twitter. In fact, about one-third of firms send not only earnings announcement (EA) tweets, but also "preview" tweets that remind followers of upcoming earnings announcements and "rehash" tweets that call attention to recently reported earnings announcements. In addition, earnings announcements are a mandatory disclosure, which allows us to disentangle the specific effects of dissemination in our empirical analyses.

We begin our analyses with an exploratory investigation of the types of firms that use Twitter in general and specifically for disseminating earnings news. Firms that have adopted Twitter tend to have a younger CEO and a business model in which advertising is a major expense, such as firms with retail customers. They also tend to issue more press releases, but interestingly, have fewer articles written about them by the traditional media (e.g., business press). This finding is consistent with the idea that these firms adopted Twitter to increase their visibility in the media and among customers. In contrast, firms that disseminate earnings news over Twitter tend to be larger firms yet have fewer Twitter followers, which suggests that they tend to have fewer retail customers. For example, we find that firms in the oil, steel, and fabrication industries have lower Twitter adoption rates than firms in the retail industry, but among those firms that have adopted Twitter, a higher percentage of the oil, steel, and fabrication firms use Twitter to disseminate earnings news.

Next, we test our hypothesis that strategic dissemination of earnings news, on a quarter-by-quarter basis, is associated with the direction of the news. While both good and bad earnings

news, as proxied by whether a firm's earnings meet or miss analyst expectations, are always disseminated through traditional channels (e.g., press release sent to newswires), we posit that firms tend not to disseminate negative earnings news through Twitter. The intuition is simple—firms (and their managers) naturally want to disseminate good news as widely as possible but not publicize bad news any more than is necessary. Despite the intuition, it is not obvious that firms will focus exclusively on the dissemination of good news. An alternative scenario is that firms with bad news may use Twitter more to mitigate investor uncertainty (Miller and Skinner 2015; Lee, Hutton, and Shu 2015). Both scenarios seem feasible and might depend on the type of information being disclosed by the firm. In our setting of earnings announcements, we find that firms are less likely to disseminate quarterly earnings news through Twitter when the news is bad and when the earnings miss is greater in magnitude, consistent with strategic behavior.

We further examine the above behavior by testing whether the extent (or amount) of strategic dissemination is associated with the direction of the news. Twitter is an ideal setting to test this hypothesis because a firm can choose to send a single message (one tweet) or multiple, repeated messages to followers about the same information event. Thus, we measure the extent of dissemination by the number of tweets that a firm sends in a given quarter about the same earnings announcements. We find some evidence, albeit weaker, that firms tend to send fewer earnings announcement (EA) tweets when the news is bad, again supporting the notion that firms strategically disseminate.

Next, we investigate how social media users respond to strategic dissemination. Twitter enables not only firms to directly tweet information to their followers, but also enables the firms' followers to "retweet" the information to their followers. We are interested in examining whether the frequency of retweeting a firm's earnings news and the size of the audience that receives the

retweet is associated with the direction of the earnings news. We find that while firms exhibit strategic behavior in their dissemination of earnings news over Twitter, their followers are not more or less likely to retweet good or bad news.

We also examine the relation between Twitter dissemination and reactions from the traditional media and the capital markets. We caution that any direction of causality is difficult to prove, as a firm's dissemination decision could be a response to the media and market reactions or vice versa. Therefore, we conduct these analyses with the intent to provide descriptive evidence on whether Twitter dissemination is associated with media and market reactions. We find some evidence that the dissemination of bad earnings news over Twitter by a firm, and the subsequent retweeting of the news by the firm's followers, are associated with more negative news articles written about the firm at the time of the earnings announcement. In terms of market reactions, we find that abnormal bid-ask spreads are smaller when a firm makes an EA tweet to a greater number of followers. However, we find that the reduction in spreads is mitigated when there are more retweets of a firm's EA tweet to users who do not directly follow the firm. These results are consistent with the notion that firm-initiated social media dissemination may improve a firm's information environment but user-initiated dialogues not controlled by the firm may have a countervailing effect. These findings for the media and market reactions highlight a potential downside to Twitter dissemination.

Finally, we conduct additional exploratory analyses to further understand the corporate use of Twitter for disseminating earnings information. We examine firms' use of preview and rehash tweets and find that firms tend to send fewer rehash tweets when the magnitude of earnings news is worse, consistent with our main results using EA tweets. We also analyze a subset of earnings-related tweets that occur during market trading hours and find elevated levels

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of trading volume and number of trades for a short window after the tweet, providing evidence of intraday market reactions associated with intraday earnings-related tweets.

This study contributes to several streams of accounting research. First, we contribute to the line of literature that examines strategic behaviors by the firm. Prior studies have examined the strategic disclosure of information and the strategic timing of disclosures to benefit firm managers (Trueman 1986; Skinner 1994; Aboody and Kasnik 2000; Doyle and Magilke 2009; Bushee, Jung, and Miller 2011; Niessner 2015). In these studies, either the decision to disclose was examined without much regard for how the disclosure was disseminated, or the decision to disclose was made jointly with the decision to use a specific communications channel.[1] We add to this literature by documenting that firms strategically disseminate information to the public.

We also add to the dissemination literature, where several studies have examined the role of the business press in disseminating firm disclosures (Bushee et al. 2010; Rogers, Skinner, and Zechman 2016; Twedt 2016). Because firms do not have significant control over how or when the business press disseminates their disclosures, they are limited in their ability to strategically disseminate via the business press. Therefore, these studies primarily document that dissemination is an important item above and beyond disclosure. We add to this literature by documenting that firms strategically disseminate information about earnings announcements through social media. Our findings contribute to our understanding of how managers try to shape a firm's overall information environment, influence how capital market participants view the firm, and affect the price discovery process.

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[1] For example, Skinner (1994) collects earnings-related disclosures from Dow Jones News Retrieval Service, and Aboody and Kasnik (2000) collect disclosures about CEO stock option awards from Standard & Poor's ExecuComp database, which come from proxy statements filed with the SEC. In the setting of conference calls and brokerage conference presentations, firm managers prepare remarks specifically for the call or presentation.

Our study also builds upon early studies that examined a firm's choice to disseminate information publicly or privately (Bamber and Cheon 1998) and studies that examined firms' decisions to post financial information to their corporate website (Ashbaugh, Johnstone, and Warfield 1999; Deller, Stubenrath, and Weber 1999; Debreceny, Gray, and Rahman 2002). Our study differs from those studies in that we examine firms' strategic dissemination after the enactment of Regulation Fair Disclosure (Reg. FD),[2] which prohibited the private dissemination or selective disclosure of information, and in an era in which mobile technologies have helped drive worldwide social media adoption to unprecedented levels.[3] As a result, dissemination through social media today reaches a broader audience much more directly and quickly than posting information to a corporate website.

Finally, our study extends recent work that examines corporate use of social media (Zhou, Lei, Wang, Fan, and Wang 2015). Blankespoor, Miller, and White (2014) examine early adopters of Twitter and find that low-visibility technology firms that use Twitter to more broadly disseminate their news can reduce information asymmetry and increase the liquidity of their stock. However, they do not find evidence of strategic dissemination, whereas, we do find such evidence using a broader and more recent sample of firms. Lee et al. (2015) examine the market and media reaction to firms' use of social media in the context of product recalls and find that firms can attenuate the negative reaction associated with product recalls, but the effect can worsen if the firm loses control of the social media dialogue. Our results complement those from Lee et al. (2015) by showing that the retweeting of bad earnings news can be associated with

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[2] Regulation Fair Disclosure was enacted in October 2000 by the Securities and Exchange Commission. It mandates that when an issuer discloses material non-public information to certain individuals or entities—generally, securities market professionals, such as stock analysts, or holders of the issuer's securities who may well trade on the basis of the information—the issuer must make public disclosure of that information.

[3] For example, Twitter disclosed in its 2015 third quarter 10-Q filing that it had 320 million monthly active users in September 2015 and Facebook disclosed in its 2015 10-K that it had 1.04 billion daily active users in December 2015. One bellwether firm such as Google can tweet information directly to over 13 million followers.

more negative traditional media coverage and mitigate the benefits associated with a reduction in information asymmetry.

The paper proceeds as follows. In Section II, we summarize the relevant literature and develop our hypotheses. In Section III, we describe the construction of our data and summarize descriptive statistics. We discuss the determinants of Twitter adoption in Section IV and the reactions in Section V. In Section VI we conduct additional analyses about firms' Twitter usage and Section VII provides concluding remarks.

## II. BACKGROUND AND HYPOTHESIS DEVELOPMENT

Strategic dissemination refers to a firm's decision to use or not use certain channels of communication to disseminate firm-specific information. A firm's decision to disseminate financial information through social media may be viewed as an extension of its disclosure strategy. Managers have capital market incentives to increase firm value, and one mechanism to achieve this goal is to reduce cost of capital through strategic disclosure (Verrecchia 1983; Botosan 1997). Strategic disclosure behavior has been documented in various settings. For example, prior studies examining firms' disclosures of earnings pre-announcements, management forecasts, and conference calls find that the direction of the earnings news (i.e., good or bad) affects aspects of the disclosure decision (e.g., Skinner 1994; Healy and Palepu 1995; Aboody and Kasznik 2000; Trueman 1986; McVay 2006). In fact, research on conference calls often focuses on how management strategically uses the venue to put a positive spin on the firm's performance (e.g., Mayew, 2008; Kimbrough and Louis 2011; Hobson, Mayew, and Venkatachalam 2012; Larcker and Zakolyukina 2012). However, this literature is generally silent about the channels of dissemination that managers should use or assume that dissemination is an

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all-or-nothing choice (e.g., if disclosure choice is binary then so is the choice to disseminate the disclosure).

Varying levels of dissemination should be a consideration within a firm's disclosure strategy because broader dissemination increases public awareness of the firm's disclosure and can increase investor recognition of the firm itself, which in theory increases firm value (Merton 1987). A number of recent empirical studies have provided evidence showing that how disclosures are disseminated matters. For example, studies have shown that increased newswire dissemination affects stock prices (Li et al. 2011), reduces information asymmetry (Bushee et al. 2010) and affects the price discovery process (Twedt 2016). These studies highlight the idea that dissemination is distinct from disclosure, and that dissemination by itself has potentially important capital market consequences. However, these studies do not identify whether firms strategically disseminate because the newswire service, rather than the firm, is making the dissemination decision. Understanding whether firms strategically disseminate is similarly important to understanding whether firms strategically disclose because strategic behaviors reveal how managers try to shape a firm's overall information environment, influence how capital market participants view the firm, and affect the price discovery process.

Social media, and in particular, Twitter, provides a unique setting to examine whether firms strategically disseminate. Conventionally, if a firm wanted to publicize investor-related information such as an earnings announcement, it would do so by sending a press release to intermediaries such as newswire services, equity research databases, and brokerage firms (Frankel, Johnson, and Skinner 1999). Under this approach, a firm would not know if or when any of its existing or prospective investors received the information. In contrast, a firm can use Twitter to: 1) directly disseminate information to its followers without an intermediary, 2)

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control the timing of the dissemination, 3) send multiple, repeated messages (or similar messages) over several days related to the same information event, and 4) know its exact number of followers.

These features suggest that firms can use Twitter to broaden dissemination and overcome a lack of investor awareness that can still persist despite dissemination through traditional channels (Blankespoor et al. 2014). Furthermore, the fact that firms can send multiple, repeated messages about the same information event suggests that it can be used to mitigate a lack of attention by investors (Hirshleifer and Teoh 2003; Hirshleifer, Lim, and Teoh 2009). Importantly, firms do not have to use Twitter to broaden or repeat dissemination of information that has also been disseminated through traditional channels, which allows us to distinguish the dissemination decision from the disclosure decision.

Based on the above discussion, we posit that when managers expect a disclosure to increase firm value (i.e., good earnings news), they will attempt to increase the breadth of dissemination using social media, which they will not do when they expect a disclosure to decrease firm value (i.e., bad earnings news). Evidence of such behavior is consistent with strategic dissemination. While it is possible that firms with bad news may use Twitter more to mitigate investor uncertainty (Miller and Skinner 2015), we believe that such use would constitute a combination of both dissemination and disclosure. For example, Lee et al. (2015) find that in a product recall setting, firms that are more proactive in using social media to manage the crisis experience less of a negative market reaction. However, the social media usage documented by Lee et al. (2015) includes new information (e.g., new clarifications and instructions on how to remedy the product defect or hazard). Since earnings announcements are a mandatory disclosure, we do not expect firms to provide new information through social media,

and hence, we do not believe firms will use social media more for negative earnings surprises. Despite our expectation that firms will increase the dissemination of good news relative to other news, finding empirical support is not obvious. In particular, if firms develop and maintain strict corporate policies to either: 1) never use social media, 2) only use social media for marketing (non-financial) purposes, or 3) use social media for financial news consistently, regardless of whether the news appears good or bad, then we would not find evidence of strategic dissemination.

As previously mentioned, we focus on quarterly earnings announcements because they are mandatory, of first-order importance to investors, and the most prevalent type of investor-related announcement disseminated through Twitter. We proxy for good and bad earning news based on whether a firm's earnings met or missed analyst expectations. We state our first hypothesis as follows.

**H1a: Strategic dissemination is associated with the direction of the news; firms are more (less) likely to disseminate good (bad) news over social media.**

We also exploit the feature of Twitter that enables firms to send multiple, repeated tweets (or similar tweets) about the same earnings announcement to measure the extent (or amount) of strategic dissemination. Similar to our first hypothesis, we expect the extent of strategic dissemination to be associated with the direction of the news.

**H1b: The extent of strategic dissemination is associated with the direction of the news; firms tend to send more good news (fewer bad news) tweets over social media.**

Beyond testing the above hypotheses, which are intended to provide evidence for our research question of whether firms use Twitter for strategic dissemination, we conduct a series of additional analyses to shed light on the consequences of disseminating earnings news over Twitter. Twitter not only enables firms to directly tweet information to their followers, but also enables the firms' followers to "retweet" the information to their followers. Thus, we examine to

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what extent (if any) a firm's Twitter followers retweet a firm's earnings announcement tweets. We also test whether dissemination through social media is associated with reactions from the traditional media and capital markets. We caution that any direction of causality is difficult to show because the media and the market could be responding to 1) dissemination over social media, 2) dissemination over traditional media, 3) the information content of the earnings announcement, or 4) the firm's decision to disseminate over social media could be a response to the media or market reactions. As a result, the purpose of our tests is to provide descriptive evidence about the relation between Twitter dissemination and the media and capital markets.

## III. DATA AND DESCRIPTIVE STATISTICS

We begin with all firms included in the S&P 1500 index as of January 2013, based on data from Compustat. We identify whether each firm has a social media presence on Twitter, Facebook, LinkedIn, Pinterest, YouTube, and Google+ by visiting each firm's corporate website and looking for icons or links to its social media sites. This step ensures that we find the firm's true corporate social media site, as opposed to sites that are managed by communities or user groups associated with the firm. If we do not find social media links on the corporate website, then we manually search for the firm's presence on the respective social media sites, taking care to use only the official corporate pages if they exist.

We find that Twitter and Facebook are the two most frequently-adopted social media platforms for corporations. We summarize our findings by industries (Fama-French 30) in Table 1, Panel A, which shows that adoption of Twitter and Facebook exceeds 47% and 44%, respectively, and is highest for customer-facing industries such as Meals, Retail, Books and Services (each over 60%) and lowest for industrial sectors such as Oil and Steel (roughly 20%).

We find much lower corporate adoption for the other social media platforms, suggesting that they are less conducive for delivering corporate communications.

We also collect data on when companies joined Twitter or Facebook by searching for the earliest tweets or posts. The time trend in corporate social media adoption for Facebook and Twitter is illustrated in Figure 1. The earliest adopters of Facebook joined in November 2007 and the first set of firms to create Twitter accounts did so in May 2008. By early 2013, the corporate adoption rate of Twitter surpassed the rate for Facebook. By the end of our data collection period, 52% of the S&P 1500 companies had adopted one or the other, and it appears that Twitter has become the preferred social media platform for companies.

Social media adoption does not necessarily imply that social media is used by firms to strategically disseminate information. Therefore, our next step is to analyze the types of investor-focused information that are disseminated by firms over social media. We focus on Twitter for this analysis since the data suggest that Twitter is the preferred social media platform, as shown in both Table 1, Panel A and the time-series trend in Figure 1. We use the Twitter Application Program Interface (API) to retrieve the full text of each tweet for each firm in our sample from the first quarter of 2010 through the first quarter of 2013.[4] We then identify tweets that fall under the purview of investor relations by manually searching for tweets about earnings announcements, dividends, share repurchases, changes in management or board of directors, mergers and acquisitions, and new announcements about investments, products, and customers.[5]

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[4] More information about the Twitter API is available at https://dev.twitter.com/rest/public. This utility provides a maximum of 3,200 tweets for any given Twitter account. For firms that had more than 3,200 tweets (214 of the 712 firms that use Twitter), we use Twitter's advanced search feature to manually retrieve the investor-related tweets.

[5] We use search terms relevant for each type of tweet. For example, to find earnings-related tweets, we search for the terms "earnings," "EPS," "profit," "income," "revenue," "sales," "results," and "quarter." After we identify a tweet based on a search term, we read the tweet to confirm that it is the correct type of investor-focused tweet.

Earnings announcement tweets are the most prevalent type of investor-focused tweets, far outnumbering tweets related to executive turnover, dividends, board of directors, and even new products and customers. Our findings are summarized in Table 1, Panel B. Over half of the 712 firms (57%) that use Twitter have tweeted earnings announcements at least once during our sample period. Because of the large number of tweets related to earnings announcements, we further partition them into three subtypes: those sent on the earnings announcement date ("EA tweets"), those sent in advance to remind investors of upcoming earnings announcements ("preview tweets"), and those that call attention to a recent earnings announcement ("rehash tweets").[6] These different types of earnings-related tweets illustrate the flexibility with which firms can control the timing of earnings dissemination over social media and the ability to send multiple, repeated messages (or similar messages) about the same information event spanning many days. We find that over one-third of the firms sent preview or rehash tweets. In Appendix B, we provide examples of preview, EA, and rehash tweets from Alcoa Inc.

The remainder of our analysis focuses on earnings-related tweets. As our evidence indicates that Twitter is the preferred social media platform for companies and that earnings announcements are the most prevalent type of investor-related tweet, focusing on earnings-related tweets should provide the most powerful research design. Furthermore, as previously discussed, this setting is advantageous because 1) earnings announcements have been shown in prior work to be of first-order importance to investors, 2) we can control for the information content of earnings announcements more effectively than the information content of other financial disclosures, and 3) we can identify the precise date and time that earnings announcements were disseminated through Twitter.

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[6] We classify earnings-related tweets as preview, EA, or rehash if they occur within window (-30, -1), (0), or (+1, +10), respectively, with day 0 being the earnings announcement date. On average, preview tweets occur 13 days before the earnings announcement date and rehash tweets occur 1 to 2 days after the earnings announcement date.

The breakdown of our sample of Twitter firms across industries (Fama-French 30) and their use of Twitter for EA, preview, and rehash tweets are provided in Table 1, Panel C. These data show that the use of Twitter for earnings news can be quite different from the general use of Twitter. For example, 18 of the 26 firms in the Meals industry use Twitter (Table 1, Panel A); however, only one of these firms made an EA or preview tweet. The pattern is similar for the Retail industry, in which only 10 of 61 firms with Twitter accounts disseminate earnings news through Twitter. In contrast, the industries with the highest percentage of firms that use Twitter to disseminate earnings, conditional on having a Twitter account, are Oil and Steel.

To shed light on variation in the consistency of firms' use of Twitter to disseminate earnings announcements each quarter, we examine quarterly dissemination patterns for each firm over our sample period. We then group firms into three categories: 1) "Regular Firms" tweeted earnings news each and every quarter after the first time, 2) "Start-Stop Firms" tweeted earnings news for one or more quarters and then stopped, and 3) "Sporadic Firms" tweeted earnings news in some quarters but not others in an apparent ad hoc manner. Table 1, Panel D presents our results; there are 132, 94, and 180 firms in the regular, start-stop, and sporadic categories, respectively. Within the group of 132 regular firms, 104 of the firms have consistently tweeted earnings news for three or more quarters in a row. This breakdown of firms indicates that there is significant cross-sectional variation in the consistency with which firms disseminate earnings announcements through Twitter, suggesting that some firms may be strategic in their use of social media.

The summary statistics in Table 1 suggest that some firms use Twitter to connect almost entirely with customers rather than with a broader group of stakeholders. This view is consistent with a recent study which finds that the marketing department supervised social media activities

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in approximately half of the surveyed firms (HBR 2010). Firms that use Twitter primarily for marketing purposes may not be appropriate control firms to use in our empirical tests because these firms have no intention of using Twitter to disseminate news to investors. For the firms that have yet to adopt Twitter, if the setup costs are low and they intend to use Twitter for more than marketing purposes, then they may be a suitable set of control firms. Furthermore, firms that have adopted Twitter and have tweeted earnings news at least once during our sample period may the better set of firms to include in our analyses of Twitter usage for quarterly earnings announcements. For these reasons, we conduct most of our analyses on both the entire sample of S&P 1500 firms and a subsample of firms that have used Twitter to disseminate earnings news at least once.

## IV. DETERMINANTS OF TWITTER USAGE

**General Twitter Usage**

While our focus is on examining whether firms use Twitter for strategic dissemination of earnings announcements, we first examine the determinants of firms' general Twitter usage to provide evidence of corporate social media adoption. We use the following firm-level, cross-sectional probit regression specification:

$$TW_i = \alpha_0 + \alpha_1 PRESS\_RELEASES_i + \alpha_2 MEDIA\_NEWS_i + \alpha_3 SIZE_i + \alpha_4 MTB_i + \alpha_5 ROA_i +$$

$$\alpha_6 GROWTH_i + \alpha_7 LEVERAGE_i + \alpha_8 ANALYSTS_i + \alpha_9 ADVERTISING_i +$$

$$\alpha_{10} FIRMAGE_i + \alpha_{11} SILICON_i + \alpha_{12} CEOAGE_i + Industry\ Fixed\ Effects + \epsilon_i \quad (1)$$

$TW_i$ is an indicator variable set to 1 (0 otherwise) if firm $i$ had a Twitter account anytime during the sample period. To test potential determinants, we include variables related to a firm's traditional media attention and other firm characteristics. We capture traditional media attention using *PRESS_RELEASES,* the log of one plus the number of corporate press releases issued by

the firm and distributed via a news provider, and *MEDIA_NEWS*, the log of one plus the number

of news articles written by traditional media organizations about the firm. Data for both variables

come from RavenPack News Analytics, a data provider that aggregates news from publishers

including Dow Jones Newswires, the Wall Street Journal, Direct Regulatory and Press Release

feeds, and over 19,000 other traditional media organizations.[7]

For other firm characteristics, we include variables that have been shown in the literature

to be determinants of disclosure through other communications channels such as conference calls

(Frankel et al., 1999), corporate websites (Ettredge et al., 2002), and conference presentations

(Bushee et al., 2011). We include firm size, measured as the log of total assets (*SIZE*), the

market-to-book ratio (*MTB*), return-on-assets (*ROA*), yearly sales growth (*GROWTH*), the debt-

to-asset ratio (*LEVERAGE*), and the log of one plus the number of analysts who cover the firm

(*ANALYSTS*). We also include variables that have been used in prior papers examining social

media adoption (e.g., Lee et al., 2015), including advertising expense scaled by total sales

(*ADVERTISING*), the number of years since a firm's founding (*FIRMAGE*), an indicator for

whether a firm is headquartered in the Silicon Valley region of Northern California (*SILICON*),

and the age of the CEO (*CEOAGE*). Data for these variables come from Compustat, I/B/E/S,

ExecuComp, or a firm's website, and they are measured as of the latest quarter prior to a firm's

Twitter adoption, or for non-adopters, the last quarter in our sample period.[8] We include industry

fixed effects and all variables are summarized in Appendix A.

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[7] RavenPack (http://www.ravenpack.com/) is one of the most well-known providers of news analytics data. RavenPack measures the news sentiment and news flow of the global equity market based on all major investable equity securities, including all press releases issued by a given firm and all new articles written about the firm.

[8] The variables are measured at the firm-level using either: 1) the first quarter in our sample period if the firm had a Twitter account at the beginning of our sample period; or 2) the last quarter before the firm initiated its first tweet if the firm opened a Twitter account during our sample period; or 3) the last available quarter in our sample period if the firm did not have a Twitter account at the end of our sample period.

The results of estimating equation (1) are presented in Column (1) of Table 2 for the 1,422 firms (out of the 1,500 firms in the S&P 1500 index) for which we have requisite data. The positive coefficients on *SIZE, MTB* and *ADVERTISING* suggest that firms with Twitter accounts tend to be larger, more valuable, and spend more on advertising expenses (e.g., because they are retail firms). In addition, these firms have lower leverage, higher analyst coverage and issue more press releases. However, the negative coefficient on *MEDIA_NEWS* indicates that fewer articles are written about these firms in the traditional media. Lastly, firms that adopted Twitter tend to have younger CEOs, but the age of the firm and whether it is located in Silicon Valley are not significant factors. In the next subsection, we compare these results to our findings for the determinants of Twitter usage for earnings news.

**Twitter Usage for Earnings News**

We next investigate the determinants of a firm's choice to use Twitter to disseminate earnings news at least once during our sample period. We run a firm-level, cross-sectional probit regression similar to equation (1), with the primary difference being that the dependent variable, $TW\_EA_i$, is an indicator variable set to 1 (0 otherwise) if firm $i$ used Twitter to disseminate earnings information at least once during the sample period (i.e., made at least one EA Tweet).[9] We run the regression first using the full sample of firms with requisite data and then using the subset of 642 firms with requisite data that have a Twitter account. However, as previously noted, we believe that including just the subsample of firms in the regression may not be ideal in terms of a control sample because some of these firms only use Twitter for marketing purposes. These firms may not be more likely to use Twitter for earnings announcements than other firms,

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[9] One other difference is that the traditional media attention variable, *NEWS_MEDIA,* is refined to focus only on articles written about a firm's earnings announcement, rather than simply about the firm (as in Table 2, column 1). We thank an anonymous reviewer for making this suggestion.

including those that have not yet opened a Twitter account. With this caveat in mind, we present the results of both regressions.

For the latter regression, we include a measure of the size of a firm's Twitter audience to test whether having a larger audience makes a firm more or less likely to tweet earnings news. We use the log of a firm's total number of Twitter followers (*FIRM_FOLLOWERS*) as of March 31, 2013. This measure is static (time-invariant) because time-series data on the number of followers for each firm is not available.[10] We caution that this measure can be a crude proxy for the number of people who see a firm's tweets because any non-follower can see a firm's tweets by actively searching for the firm on Twitter and any follower can miss a firm's tweets on their "feeds." However, one advantage of the measure is that firms know with certainty their number of followers and that knowledge is likely a factor in their decision to disseminate any type of information over Twitter. Therefore, we view a firm's number of followers as a suitable proxy for the size of a firm's *intended* social media audience.

The results of the full sample regression are provided in Column (2) of Table 2, and the results of the subsample regression are in Column (3). The significantly positive coefficients for *PRESS_RELEASES* and *SIZE* in both columns indicate that larger firms and firms that issue more press releases tend to disseminate earnings news over Twitter. The significantly negative coefficients for *MEDIA_NEWS* in both columns indicate that firms with fewer articles written about their earnings news from the traditional media are more likely to disseminate earnings news over Twitter. The negative coefficient for *CEOAGE* in column (2), but not column (3), suggests that across all firms, those with younger CEOs are more likely to adopt Twitter and use

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[10] We also collected the static count as of June 30, 2015, which is after our sample period, to check that the use of a static count does not drive our results. We find that most firms experienced consistent increases in their number of followers since March 31, 2013. The only exceptions were firms that had recently opened Twitter accounts as of 2013. We find that our inferences are unchanged when we use the static count as of June 30, 2015 in our analyses.

it for earnings news. But conditional on having a Twitter account already, CEO age is not a significant factor. The negative coefficient for *FIRM_FOLLOWERS* in column (3) indicates that firms with fewer followers are more likely to use Twitter for earnings information. This result is consistent with the summary statistics in Section III, which indicated that firms in customer-facing industries (e.g., retail) were less likely to use Twitter for earnings news while firms in industrial industries (e.g., Oil and Steel) were more likely to do so.

A number of differences exist between the choice to have a Twitter account, modeled in column (1), and the choice to use Twitter to disseminate earnings information, modeled in column (3). While firms with greater analyst coverage are more likely to have a Twitter account, there is no difference in analyst coverage for firms that use and do not use Twitter for earnings news. In addition, while firms with high levels of advertising tend to have Twitter accounts, those with low levels of advertising tend to use Twitter to disseminate earnings. This evidence suggests that firms that use Twitter for earnings and those that use Twitter in general are fundamentally different, consistent with the earlier discussion in Section III.

**Quarter-by-Quarter Dissemination of Earnings News Using Twitter**

In this subsection we formally test our first hypothesis (H1a) that strategic dissemination is associated with the direction (good or bad) of quarterly earnings news. We model a firm's choice to make an earnings announcement (EA) tweet on a quarter-by-quarter basis using a panel regression with firm-quarter observations. The probit regression specification is similar to equation (1), except that the dependent and independent variables are measured quarterly, allowing us to test whether time-varying earnings news and firm characteristics are associated

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with the decision to tweet earnings news in a given quarter.[11] Also, similar to our analysis in the previous subsection, we run the regression first using the full sample of firm-quarters and then using the subset of firm-quarters for firms that have tweeted earnings news at least once during the sample period. The specification we employ is as follows:

$$TW\_EA\_Q_{i,q} = \gamma_0 + \gamma_1 MISSEST_{i,q} + \gamma_2 |EARNINGS\_SURPRISE|_{i,q} +$$

$$\gamma_3 MISSEST_{i,q}*|EARNINGS\_SURPRISE|_{i,q} + \gamma_4 PRESS\_RELEASES_{i,q} +$$

$$\gamma_5 MEDIA\_NEWS_{i,q} + \gamma_6 SIZE_{i,q} + \gamma_7 MTB_{i,q} + \gamma_8 ROA_{i,q} + \gamma_9 GROWTH_{i,q} +$$

$$\gamma_{10} LEVERAGE_{i,q} + \gamma_{11} ANALYSTS_{i,q} + \gamma_{12} ADVERTISING_{i,q} + \gamma_{13} FIRMAGE_{i,q} +$$

$$\gamma_{14} SILICON_{i,q} + \gamma_{15} CEOAGE_{i,q} + Industry\ and\ Quarter\ Fixed\ Effects + \epsilon_{i,q} \qquad (2)$$

$TW\_EA\_Q_{i,q}$ is an indicator variable set to 1 (0 otherwise) if firm $i$ disseminated at least one EA tweet for fiscal quarter $q$. The independent variables of interest are $MISSEST_{i,q}$, an indicator variable set to 1 (0 otherwise) if firm $i$'s actual EPS is below the latest consensus mean analyst forecast for quarter $q$, the absolute earnings surprise $|EARNINGS\_SURPRISE|_{i,q}$, defined as the absolute value of the firm's actual EPS minus the latest consensus mean analyst forecast, scaled by stock price at the end of the quarter, and their interaction term $MISSEST_{i,q}*|EARNINGS\_SURPRISE|_{i,q}$. For ease of interpretation and to reduce multicollinearity, we demean the continuous $|EARNINGS\_SURPRISE|$ variable when computing the interaction term. All other independent variables are previously defined and we include quarter fixed effects in addition to industry fixed effects.[12]

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[11] Independent variables are measured prior to the EA tweet. For example, if a firm's first fiscal quarter is from Jan. 1 to March 31, and the earnings announcement and EA tweet occur on April 20th, our calculations of the independent variables are for the quarter from Jan 1. to March 31, which is prior to the EA Tweet.

[12] In robustness tests, we include firm fixed effects because it is possible that an unobserved firm-specific factor exists whose omission from our multivariate analysis is material. This approach is very conservative in our setting since our dataset only covers 13 quarters. None of our inferences are affected by this inclusion.

Descriptive statistics of the variables used in the panel regression are provided in Table 3, Panel A. Continuous variables are winsorized at the 1st and 99th percentiles. Of the 18,706 firm-quarters in our full sample, firms made an EA tweet in 11.8% of the firm-quarters, and they missed analysts' consensus expectations in 26.6% of the firm-quarters.

The results of the full sample regression are provided in column (1) of Table 3, Panel B, and the results of the subsample regression are in column (2). In both columns, the coefficients for *MISSEST* and the interaction term *MISSEST\*|EARNINGS_SURPRISE|* are significantly negative, indicating that firms that miss analyst earnings expectations and miss by larger amounts are less likely to tweet earnings news over Twitter. The marginal effect of missing expectations (*MISSEST*=1) is a 1.4% decrease in the probability of sending an EA tweet, which may appear nominal on an absolute basis, but it represents 12% of the unconditional probability (11.8%) of a firm sending an EA tweet in a given quarter. These results support our first hypothesis that the decision to disseminate earnings news over Twitter is related to the direction of earnings news, which is consistent with strategic dissemination behavior by firms.

To provide further evidence on strategic dissemination in the social media setting, we test the second part of our hypothesis (H1b) that the extent (or amount) of dissemination is associated with the direction of quarterly earnings news. We replace the binary dependent variable in equation (2) (*TW_EA_Q*) with a continuous variable (*TW_EA_NUM*) that is the log of one plus the number of EA tweets that a firm made for fiscal quarter *q*. The results of the full sample OLS regression are provided in column (3) of Table 3, Panel B, and the results of the subsample regression are in column (4). The coefficients for *MISSEST* are negative in both columns (significant at the 10% level), indicating that across all firms and the subset that have ever used Twitter for earnings news, the quarters in which a firm missed analyst earnings expectations tend

to have fewer EA tweets. The coefficients for the interaction terms are negative but not significant, suggesting that the magnitude of the earnings miss is not correlated with the number of EA tweets. Overall, the results in Panel C provide some support for H1b that the extent of strategic dissemination each quarter is associated with the direction of earnings news.

## V. RESPONSE TO FIRMS' TWITTER USAGE

**Response by Firms' Twitter Followers to Earnings Tweets**

In this section, we investigate how a firm's social media audience responds to dissemination of earnings news. Twitter not only enables firms to directly tweet information to their followers, but also enables the firms' followers to "retweet" the information to their followers. We are interested in examining whether the frequency of retweeting a firm's earnings news and the size of the audience that receives the retweet is associated with the direction of the earnings news. To measure this extension of a firm's Twitter audience, we identify the number of followers of each person who retweeted the firm's EA tweet (hereafter referred to as a "retweeter"). The intention is to roughly assess the order of magnitude of Twitter users who do not follow a firm directly but still see a firm's EA tweet through another user. For each initial EA tweet sent by a firm in a given quarter, we retrieve all of its retweets using the Twitter API and identify the name of the retweeter and the number of followers of each retweeter.[13] Our count of the number of followers of all retweeters proxies for the number of individuals who receive the firm's EA tweet but do not directly follow the firm.

Table 4 provides the results of estimating regression equation (2) using the log of one plus the number of retweets per EA tweet as the dependent variable (*EA_RETWEETS*) in

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[13] Similar to our method of retrieving firms' earnings announcement (EA) tweets, the Twitter API allows us to retrieve retweets of a given tweet. Due to the computational complexity of retrieving and tracking users' retweets of firms' EA tweets, we focus on the first EA tweet made by a firm in a given quarter if there are multiple EA tweets.

Column (1) and the log of the total followers of all retweeters (*RETWEET_FOLLOWERS*) in Column (2). We do not find any significant coefficients for our variables of interest, *MISSEST* and its interaction with the absolute earnings surprise, |*EARNINGS_SURPRISE*|. The lack of significance suggests that while firms exhibit strategic behavior in their dissemination of earnings news over Twitter, their followers are not more or less likely to retweet good or bad news. Only the coefficients for firm size and the market-to-book ratio are significantly positive, indicating followers of firms that are larger and have higher relative valuations tend to retweet a firm's earnings news to a larger extended audience.

**Earnings Tweets and Traditional Media**

We next examine whether retweeting activity by a firm's followers is associated with traditional media attention. The amount of retweeting, and more importantly, the number of followers of the retweeters, could be related to traditional media attention. We caution that an association (if any) may be due to the media responding to a firm's followers or vice versa; therefore, we do not imply a specific direction of causality. To test these associations, we run the following regression specification.

$$EA\_NEWS_{i,q} \text{ (Total, Positive, Negative)} = \rho_0 + \rho_1 RETWEET\_FOLLOWERS_{i,q} +$$

$$\rho_2 RETWEET\_FOLLOWERS_{i,q} * MISSEST_{i,q} + \sum \rho_i Control\ Variables_{i,q} +$$

$$Industry\ and\ Quarter\ Fixed\ Effects + \epsilon_{i,q} \tag{3}$$

$EA\_NEWS_{i,q}$ is the log of one plus the number of news articles written by traditional media organizations about the firm's earnings during the three-day window centered on the firm's earnings announcement date. RavenPack News Analytics classifies news articles as positive or negative based on a sentiment score between 0 and 100, with 50 representing neutral sentiment.

Therefore, we also partition the log number of news articles into positive (*EA_NEWS_POS*) and negative (*EA_NEWS_NEG*) news. *RETWEET_FOLLOWERS* is the log of one plus the total number of followers of users who retweeted a firm's EA tweet, and we interact that variable with *MISSEST* to test whether any association differs based on the direction of the news. As with previous regressions, we control for firm size, market-to-book, performance, growth, analyst coverage, a missed estimates indicator, and the absolute earnings surprise. We also control for the number of followers that receive an EA tweet from the firm directly with *EA_FIRM_FOLLOWERS*, defined as the log of a firm's total number of Twitter followers as of March 31, 2013 when a firm makes an EA tweet and zero when a firm does not make an EA tweet.

The results of estimating equation (3) are presented in Table 5. In Column (1), where the dependent variable is *EA_NEWS*, the coefficients for *RETWEET_FOLLOWERS* and its interaction with *MISSEST* are insignificant. The results are similar in Column (2), where the dependent variable captures the number of positive news articles about a firm (*EA_NEWS_POS*). In Column (3), however, when the dependent variable is *EA_NEWS_NEG*, the coefficient for the interaction term is positive (significant at the 10% level), which suggests that when a firm makes an EA tweet regarding the missed analyst expectations and it is retweeted by the firm's followers, the number of users who receive the retweet is associated with greater negative media attention about the firm's earnings announcement. These results may reflect a proclivity of both social media users and traditional media organizations for negative news stories. Overall, we interpret the results in Table 5 to suggest that the dissemination of bad earnings news over Twitter by a firm, and the subsequent retweeting of the news by the firm's followers, are

associated with more negative news articles written about the firm at the time of the earnings announcement, highlighting a potential downside to Twitter dissemination.

**Earnings Tweets and Market Reactions**

We also examine whether a firm's tweeting of earnings announcements and the subsequent retweeting by the firm's followers are associated with capital market reactions. As with our previous analyses, we caution that our tests do not identify a particular direction of causality, as the market may react to an earnings announcement disseminated through traditional or social media, or a firm's decision to disseminate over social media may be a reaction to the firm's stock price movements. Again, our intention is to provide evidence about social media dissemination and capital markets, as well as to tie any results to prior papers that have examined this relation.

We focus our analysis on relating market reactions to the size of a firm's direct and indirect Twitter audiences: 1) the number of firm followers who receive an EA tweet directly from the firm and 2) the number of followers of people who retweeted the firm's EA tweet. If there is a relation, then we expect it to depend on the size of these audiences and not the mere presence of the tweet or retweet itself. For example, a firm with zero Twitter followers would not affect levels of dissemination or market reactions by tweeting an earnings announcement. A difference between the two audiences is that the former chooses to follow a firm and is likely familiar with the firm's past earnings announcements and EA tweets, while the same cannot be said of the latter. Retweets result in more individuals who do not directly follow a firm receiving

that firm's EA tweet than if there were no retweets.[14] If these individuals behave as uninformed investors, as modeled in Diamond and Verrecchia (1991) and Kim and Verrecchia (1994), then they may contribute to greater information asymmetry (or offset reductions in information asymmetry) at the time of an earnings announcement.

Using daily stock return, volume, and bid-ask spread data from CRSP, we define three market measures to proxy for the information content and information asymmetry surrounding a firm's earnings announcement. First, we compute the abnormal absolute value of size-adjusted returns (*ABN_SAR*) as the difference between three-day absolute size-adjusted return surrounding the earnings announcement date and the mean three-day absolute size-adjusted return in an estimation period, divided by the standard deviation of the mean absolute size-adjusted return in the estimation period (Cready and Hurtt 2002; Bushee et al. 2011). Second, we measure abnormal share turnover (*ABN_TURN*) as the three-day volume divided by shares outstanding, less the average three-day turnover in the estimation period. Third, we compute abnormal spread (*ABN_SPREAD*) as the three-day average spread (ask minus bid price, divided by their mean), less the average three-day spread in the estimation period. For each variable, the estimation period consists of 60 calendar days, beginning 61 days prior to the earnings announcement date and ending 2 days prior to that date. We estimate the following regression specification on our full sample for firm-quarters:

$$Market\ Variable_{i,q} = \beta_0 + \beta_1 EA\_FIRM\_FOLLOWERS_{i,q} + \beta_2 RETWEET\_FOLLOWERS_{i,q}$$

$$\beta_3 EA\_FIRM\_FOLLOWERS*|EARNINGS\_SURPRISE|_{i,q} +$$

$$\beta_4 RETWEET\_FOLLOWERS*|EARNINGS\_SURPRISE|_{i,q} +$$

$$\sum \beta_i Control\ Variables_{i,q} + Industry\ and\ Quarter\ Fixed\ Effects + \epsilon_{i,q} \qquad (4)$$

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[14] The only possible exception to this effect is when all retweeters have followers who are also followers of the firm. As long as there are non-overlapping followers of the firm and the retweeter, then more retweets will result in a greater number of individuals who do not follow the firm receiving the firm's EA tweet.

*Market Variable* represents *ABN_SAR*, *ABN_TURN*, and *ABN_SPREAD*. As previously defined, *EA_FIRM_FOLLOWERS* is the log of a firm's total number of Twitter followers as of March 31, 2013 when a firm makes an EA tweet and zero when a firm does not make an EA tweet, and *RETWEET_FOLLOWERS* is the log of one plus the total number of followers of users who retweeted a firm's EA tweet. We also include the interaction of a firm's direct or indirect audience size with the absolute earnings surprise to test if an association between social media and market reactions depends on the magnitude of the news. Control variables include the absolute earnings surprise, a missed estimates indicator, media attention during the three-day market reaction window, firm size, market-to-book, performance, growth, and analyst coverage.

The results of estimating equation (4) are presented in Table 6. When the dependent variable is *ABN_SAR* (Columns (1) and (2)), the coefficient for *EA_FIRM_FOLLOWERS* is significantly positive (at the 10% level), indicating a larger market reaction when a firm makes an EA tweet and its Twitter audience is larger. This association holds after controlling for the earnings surprise, firm size, performance, growth, leverage and analyst coverage. In contrast, the coefficient for *RETWEET_FOLLOWERS* is not significant, nor are any interactions with |*EARNINGS_SURPRISE*|. When the dependent variable is *ABN_TURN* (Columns (3) and (4)), the coefficients for *EA_FIRM_FOLLOWER* and *RETWEET_FOLLOWER* are both insignificant. These results provide only limited support for an association between the size of a firm's direct Twitter audience that receives an EA tweet and the market reaction at the time of the earnings announcement.

When the dependent variable is *ABN_SPREAD* (Columns (5) and (6)), which is a measure of information asymmetry, the coefficient for *EA_FIRM_FOLLOWERS* is significantly negative, indicating a smaller spread when a firm makes an EA tweet to a greater number of

followers. This result is consistent with those found in Blankespoor et al. (2014) using a smaller set of early Twitter adopter firms and different measures of Twitter dissemination. However, we find a significantly positive coefficient at the 5% level for *RETWEET_FOLLOWERS*, which suggests that the reduction in spreads is mitigated when there are more retweets of a firm's EA tweet to users who do not directly follow the firm. In Column (6), the coefficient for the interaction of *RETWEET_FOLLOWERS* and the absolute earnings surprise is significantly positive at the 10% level, indicating that the previous result is stronger when the magnitude of the earnings news is larger. These results are consistent with the notion that firm-initiated social media dissemination may improve a firm's information environment but user-initiated dialogues not controlled by the firm may have a countervailing effect (Lee et al. 2015).

## VI. ADDITIONAL ANALYSES

### Quarter-by-Quarter Dissemination of Preview and Rehash Tweets

In this subsection, we examine whether firms' decisions to disseminate preview or rehash earnings tweets are associated with the direction of earnings news. Preview tweets are sent by a firm to remind followers of upcoming earnings announcements and rehash tweets call attention to a recent earnings announcement. We estimate equation (2) using *TW_EA_NUMPREVIEW* and *TW_EA_NUMREHASH* as the dependent variables, defined as one plus the log of the number of preview and rehash tweets, respectively, sent by a company each quarter. Columns (1) and (2) in Table 7 show the results for preview tweets, run on the full sample first and then on the subsample of firms that use Twitter for earnings news at least once. Across all firms, larger firms and firms that issue more press releases tend to send more preview tweets, while there is no difference across firms that use Twitter for earnings. The coefficients for *MISSEST* and its interaction with the absolute earnings surprise are not significant in either column. Columns (3)

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and (4) show the results for the rehash tweets; larger firms and firms that spend less on advertising (e.g., non-retail firms) tend to send more rehash tweets. We also find that the interaction term *MISSEST\*|EARNINGS_SURPRISE|* is significantly negative (at the 10% level) in each column, indicating that across all firms and within Twitter firms, they tend to send fewer rehash tweets when earnings news is worse. This evidence provides additional support for our hypotheses that firms' dissemination of earnings news and the extent (amount) of dissemination are associated with the direction of the news.

**Earnings Tweets and Intraday Market Reactions**

In our final analysis, we analyze intraday market reactions to EA, preview, and rehash tweets for the subset of firms that tweet during market trading hours. Knowing the exact date and time of each tweet, and using intraday data from the NYSE Trade and Quote (TAQ) database, we compare the market reaction for the 15 minutes after the tweet to the market reaction for the 15 minutes before the tweet. We view this analysis as exploratory because the sample sizes are small, the event windows are short (to reduce confounding news during the event and control windows), and there is possible self-selection bias for firms that choose to tweet earnings information during market hours.

We measure market reactions using two volume-based measures. Abnormal volume is the percentage change in total trading volume from the 15 minutes before the tweet to the 15 minutes after the tweet. Abnormal number of trades is the percentage change in the total number of trades from 15 minutes before to 15 minutes after the tweet. We require all EA, preview, and rehash tweets to occur between 9:45am and 3:45pm Eastern Time to allow for trading during the event and control windows. Finally, to minimize the possibility that any other type of firm news

(besides the firm's tweet) occurs during the event or control windows (which would confound the market reactions associated with the tweets), we once again use data from RavenPack News Analytics to first identify all firm news with a date and time stamp within 15 minutes of the intraday tweets. We then include in our analysis only those tweets that do not have any other news occurring within the event and control windows.

In untabulated results, we find 230 EA tweets that occur during market trading hours, and the mean abnormal volume and number of trades is 35% and 54%, respectively (both significant at the 1% level). In other words, there are significantly elevated levels of trading volume and number of trades, on average, in the 15 minutes after an EA tweet, compared to the 15 minutes before the tweet. One explanation could be that an EA tweet occurs on the same day as a firm's earnings announcement, and there may be elevated trading throughout the day. However, we find similar results with preview and rehash tweets even though preview tweets occur, on average, 13 days prior to the earnings announcement, and the rehash tweets occur, on average, 1-2 days after the earnings announcement. We find 531 preview tweets during trading hours, and the mean abnormal volume and number of trades is 40% and 33%, respectively. There are also 307 rehash tweets during trading hours, and the mean abnormal volume and number of trades is 42% and 43%, respectively. We view these findings as evidence of intraday market reactions associated with intraday earnings-related tweets.


## VII. CONCLUSION

In this paper, we use the social media setting to examine whether firms are strategic in their decisions to disseminate earnings news over social media. This setting is ideal for this research question because firms do not have to disseminate news over Twitter that has already

been disseminated through traditional channels, allowing us to distinguish a firm's disclosure decision from its dissemination decision. Our results show that firms are less likely to disseminate quarterly earnings news through Twitter when the news is bad and also less likely when the earnings miss is greater in magnitude, consistent with strategic behavior. We find some evidence, albeit weaker, that firms tend to send fewer earnings announcement (EA) tweets when the news is bad, again supporting the notion that firms strategically disseminate.

We also document the adoption of social media by the largest publicly-traded companies in the U.S. and their specific use of social media to disseminate financial information to investors. The usage of social media by corporations has grown dramatically over a relatively short period of time, from less than 5% of firms in 2008 to more than 50% of firms in 2013. This trend suggests that social media usage for communicating with investors has the potential to become an integral part of many firms' disclosure policies. We show that firms used it to disseminate a variety of information, including earnings news, board and executive changes, new contracts, and dividends.

These findings contribute to the disclosure literature and the related dissemination literature, which have examined firms' disclosure and dissemination decisions in conjunction or used empirical settings in which the two decisions were inseparable. Our study extends recent work that examines corporate use of social media (Blankespoor et al. 2014) and its potential pitfalls (Lee et al. 2015) by showing that the tweeting and retweeting of bad earnings news can be associated with more negative traditional media coverage, and that retweeting in general can mitigate the benefits associated with a reduction in information asymmetry

# APPENDIX A: Variable Descriptions and Data Sources

| Variable | Description | Data Source |
|---|---|---|
| **Twitter Variables** | | |
| *TW* | Indicator variable set to 1 if the firm has a Twitter account any time during the sample period. | Twitter |
| *TW_EA* | Indicator variable set to 1 if the firm tweeted earnings news at any time during the sample period. | Twitter |
| *TW_EA_Q* | Indicator variable set to 1 if the firm disseminated at least one EA tweet for fiscal quarter q. | Twitter |
| *TW_EA_NUM* | Log of one plus the number of EA tweets that a firm made for fiscal quarter q. | Twitter |
| *TW_EA_NUMPREVIEW* | Log of one plus the number of preview EA tweets that a firm made for fiscal quarter q. | Twitter |
| *TW_EA_NUMREHASH* | Log of one plus the number of rehash EA tweets that a firm made for fiscal quarter q. | Twitter |
| *FIRM_FOLLOWERS* | Log of the number of Twitter followers that a firm had as of March 31, 2013. | Twitter |
| *EA_RETWEETS* | Log of one plus the number of retweets per EA tweet | Twitter |
| *RETWEET_FOLLOWERS* | Log of the number of followers of all retweeters of a firm's EA tweet. | Twitter |
| **Market Reaction Variables** | | |
| *ABN_SAR* | Difference between three-day absolute size-adjusted returns and the mean three-day absolute size-adjusted returns in an estimation period, divided by the standard deviation of the mean absolute size-adjusted returns in the estimation period. The estimation period begins 61 calendar days prior to the earnings announcement date and ends 2 days prior to that date. | CRSP |
| *ABN_TURN* | Three-day volume divided by shares outstanding, less the average three-day turnover in the estimation period. The estimation period begins 61 calendar days prior to the earnings announcement date and ends 2 days prior to that date. | CRSP |
| *ABN_SPREAD* | Three-day average spread (ask minus bid price, divided by their mean), less the average three-day spread in the estimation period, multiplied by 10,000 to ease interpretation. The estimation period begins 61 calendar days prior to the earnings announcement date and ends 2 days prior to that date. | CRSP |

**Traditional Media Variables**

| | | |
|---|---|---|
| *PRESS_RELEASES* | Log of one plus the number of press releases issued by the firm and distributed via a news provider during the quarter. | RavenPack |
| *MEDIA_NEWS* | Log of one plus the number of news articles written about a firm's earnings announcement during the quarter. | RavenPack |
| *EA_NEWS* | Subset of *MEDIA_NEWS* during the three-day QEA window. | RavenPack |
| *EA_NEWS_POS* | Subset of *EA_NEWS* that has a sentiment score above 50. RavenPack News Analytics constructs a sentiment score between 0 and 100 that represents the news sentiment of a given story by combining various sentiment analysis techniques. The direction of the score is determined by looking at emotionally charged words and phrases and matching stories typically rated by experts as having short-term positive or negative share price impact. The strength of the score (values above or below 50, where 50 represents neutral strength) is determined from intraday stock price reactions modeled empirically using tick data from approximately 100 large cap stocks. | RavenPack |
| *EA_NEWS_NEG* | The subset of *EA_NEWS* that has a sentiment score below 50. | RavenPack |

**Firm Characteristic Variables**

| | | |
|---|---|---|
| *MISSEST* | Indicator variable set to 1 if the firm's actual EPS is below the consensus analyst forecast for the quarter | I/B/E/S |
| *|EARNINGS_SURPRISE|* | Absolute value of the firm's actual EPS minus the consensus analyst forecast for the quarter, scaled by stock price | I/B/E/S |
| *SIZE* | Natural logarithm of total assets | Compustat |
| *MTB* | Ratio of the market value of equity to the book value of common equity | Compustat |
| *ROA* | Income before extraordinary items divided by total assets | Compustat |
| *GROWTH* | Year-over-year percentage change in quarterly sales | Compustat |
| *LEVERAGE* | Sum of long-term debt and debt in current liabilities divided by total assets | Compustat |
| *ANALYSTS* | Natural logarithm of the number of analysts that have issued an EPS forecast for a firm for a given quarter | I/B/E/S |
| *ADVERTISING* | Advertising expense scaled by total sales | Compustat |
| *FIRMAGE* | Number of years since the firm's founding | Firm Website |
| *SILICON* | Indicator variable set to 1 if a firm is headquartered in the Silicon Valley area of Northern California | Compustat |
| *CEOAGE* | Age of the CEO in years. | ExecuComp |

## APPENDIX B: Earnings-Related Tweets ("EA", "Preview" and "Rehash")

Alcoa Inc. "preview" tweets about its upcoming earnings announcement.

*Apr. 9, 2012: Reminder: Alcoa to Host Webcast of First Quarter 2012 Results, Apr. 10, 2012 beginning at 5:00 p.m. ET $AA http://t.co/agPHyg0r*

*Apr. 4, 2012: Alcoa to Host Webcast of First Quarter 2012 Results - NEW YORK--(BUSINESS WIRE)--Alcoa (NYSE:AA) will hold a confere... http://t.co/Tj2mHIFK*

Alcoa Inc. tweets about its earnings announcement on 4/10/2012.

(in descending order by time)

*$AA Listen to replay of Alcoa's 1Q12 earnings available at http://t.co/aqjK8yix from: 04/10/2012 07:00 PM ET to 04/18/2012 11:59 PM ET*

*$AA CEO Kleinfeld: Alcoa continues to meet aggressive operational and financial targets http://t.co/BFnqGtWZ*

*$AA CEO Kleinfeld: Alcoa performance rebounded this quarter as proactive cash sustainability actions deliver results http://t.co/DMyOmJOD*

*$AA CEO Kleinfeld: Repositioning upstream to drive increased profitability; growing high margin growth in downstream http://t.co/gn0Ly5j1*

*$AA CEO Kleinfeld: Relentless cash focus is $AA hallmark - shaved 7 days off working capital, strong productivity gains http://t.co/5KQ6j9fV*

*$AA CEO Kleinfeld: China aluminum industry remains challenged "high cost and low sustainability http://t.co/0EeDGjVQ*

*$AA CEO Kleinfeld: Reaffirming 7% global aluminum demand growth forecast & global aluminum supply deficit in 2012 http://t.co/WRUYKIlC*

*AA CEO Kleinfeld: See global end market growth in 2012; aerospace growth forecast increased & Alcoa has strong exposure http://t.co/KbyT1HmN*

*Alcoa 1Q12 Earnings Presentation slide deck http://t.co/SnLFz3R9 via @slideshare $AA*

*CEO Kleinfeld "Performance rebounded strongly on proactive cash sustainability actions, focus on profitable growth, & stabilizing markets •*

*Alcoa reports 1Q12 "AA earnings rebound strongly, up $287m over 4Q11 on strong productivity growth, improved market conditions*

*Alcoa Earnings Rebound Over Prior Quarter on Higher Productivity, Improved Market Conditions http://t.co/AhszlHwa*

*Tune In to Webcast of First Quarter 2012 Results, beginning at 5:00 p.m. ET at http://t.co/hl7eWLMl $AA*

*Alcoa reports 1Q12 "$AA reaffirms 7% global aluminum demand growth forecast & global aluminum supply deficit in 2012 http://t.co/YswCmLJQ*

*Link to $AA 1Q 2012 press release: http://t.co/CdMy5u3O*

*Alcoa reports 1Q12 "Alcoa's midstream business delivers record Q1 results, despite EU weakness $AA http://t.co/C8rTIuX9*

*Alcoa reports 1Q12 "Alcoa's downstream businesses rewriting the record books - posts record quarterly margin $AA http://t.co/D3iLL12y*

*Alcoa reports 1Q12 "Record results in Global Rolled Products and Engineered Products and Solutions segments $AA http://t.co/b53bZe1u*

*Alcoa Reports 1Q12 "Cash sustainability actions deliver - Days working capital 1st qtr record, Cash on hand $1.7b $AA http://t.co/cTEURL4y*

*Alcoa reports 1Q12 - Revenue of $6.0 billion, up Y/Y despite 9% decline in realized aluminum prices $AA http://t.co/BecmzNQP*


Alcoa Inc. "rehash" tweets about its earnings announcement.

*Apr. 12, 2012: What made 1Q great? Alcoa Chairman Klaus Kleinfeld looks underneath the hood w/ Fox Business host @LizClaman. Video: http://t.co/br7H0TIQ*

*Apr. 11, 2012: Alcoa's Earnings Like a Rorschach Test by @MarekFuchs @TheStreet http://t.co/TR9z02of*

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**FIGURE 1: Adoption of Twitter and Facebook over Time by S&P 1500 Firms**
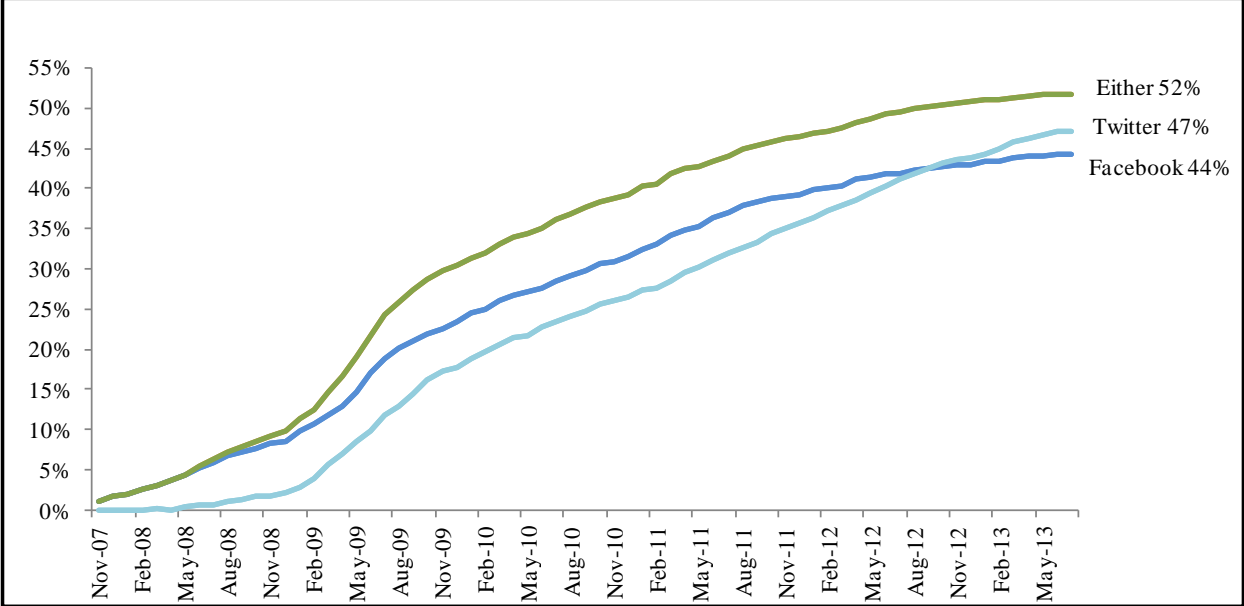
**TABLE 1: Sample and Summary Statistics**
**Panel A: Social Media Adoption by S&P 1500 Firms and by Industries**

| Industry | Unique Firms | Twitter N | Twitter % | Facebook N | Facebook % | YouTube N | YouTube % | LinkedIn N | LinkedIn % | Google+ N | Google+ % | Pinterest N | Pinterest % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Autos | 19 | 6 | 31.6 | 7 | 36.8 | 5 | 26.3 | 3 | 15.8 | - | - | - | - |
| Beer | 7 | 4 | 57.1 | 3 | 42.9 | 2 | 28.6 | 1 | 14.3 | - | - | - | - |
| Books | 9 | 7 | 77.8 | 6 | 66.7 | 4 | 44.4 | 2 | 22.2 | 1 | 11.1 | - | - |
| Bus. Equip. | 170 | 103 | 60.6 | 92 | 54.1 | 80 | 47.1 | 83 | 48.8 | 27 | 15.9 | 1 | 0.6 |
| Carry | 13 | 5 | 38.5 | 4 | 30.8 | 4 | 30.8 | 4 | 30.8 | - | - | - | - |
| Chemicals | 35 | 15 | 42.9 | 13 | 37.1 | 10 | 28.6 | 10 | 28.6 | 1 | 2.9 | 1 | 2.9 |
| Clothing | 25 | 13 | 52.0 | 13 | 52.0 | 10 | 40.0 | 2 | 8.0 | 1 | 4.0 | 5 | 20.0 |
| Construction | 45 | 17 | 37.8 | 15 | 33.3 | 11 | 24.4 | 8 | 17.8 | 4 | 8.9 | 6 | 13.3 |
| Coal | 5 | 3 | 60.0 | 2 | 40.0 | 2 | 40.0 | 1 | 20.0 | - | - | - | - |
| Electronics | 18 | 7 | 38.9 | 7 | 38.9 | 6 | 33.3 | 7 | 38.9 | 2 | 11.1 | 1 | 5.6 |
| Fab. Prods. | 56 | 22 | 39.3 | 20 | 35.7 | 22 | 39.3 | 15 | 26.8 | 7 | 12.5 | 1 | 1.8 |
| Financial | 283 | 112 | 39.6 | 103 | 36.4 | 62 | 21.9 | 71 | 25.1 | 23 | 8.1 | 10 | 3.5 |
| Food | 41 | 16 | 39.0 | 16 | 39.0 | 10 | 24.4 | 5 | 12.2 | 2 | 4.9 | 2 | 4.9 |
| Games | 18 | 12 | 66.7 | 9 | 50.0 | 7 | 38.9 | 3 | 16.7 | 4 | 22.2 | 5 | 27.8 |
| Health | 103 | 37 | 35.9 | 26 | 25.2 | 20 | 19.4 | 25 | 24.3 | 3 | 2.9 | 1 | 1.0 |
| Household | 24 | 11 | 45.8 | 11 | 45.8 | 9 | 37.5 | 5 | 20.8 | 1 | 4.2 | 2 | 8.3 |
| Meals | 26 | 18 | 69.2 | 19 | 73.1 | 12 | 46.2 | 1 | 3.8 | 4 | 15.4 | 4 | 15.4 |
| Mines | 9 | 3 | 33.3 | 3 | 33.3 | 2 | 22.2 | 3 | 33.3 | - | - | - | - |
| Oil | 64 | 14 | 21.9 | 12 | 18.8 | 10 | 15.6 | 13 | 20.3 | 3 | 4.7 | - | - |
| Other | 35 | 14 | 40.0 | 16 | 45.7 | 14 | 40.0 | 11 | 31.4 | 3 | 8.6 | 2 | 5.7 |
| Paper | 27 | 10 | 37.0 | 9 | 33.3 | 7 | 25.9 | 5 | 18.5 | 1 | 3.7 | 2 | 7.4 |
| Retail | 92 | 61 | 66.3 | 65 | 70.7 | 43 | 46.7 | 6 | 6.5 | 17 | 18.5 | 29 | 31.5 |
| Services | 161 | 106 | 65.8 | 102 | 63.4 | 67 | 41.6 | 85 | 52.8 | 38 | 23.6 | 8 | 5.0 |
| Smoke | 4 | 1 | 25.0 | - | - | - | - | - | - | - | - | - | - |
| Steel | 22 | 3 | 13.6 | 5 | 22.7 | 7 | 31.8 | 7 | 31.8 | - | - | - | - |
| Telecom | 34 | 25 | 73.5 | 20 | 58.8 | 11 | 32.4 | 11 | 32.4 | 3 | 8.8 | 3 | 8.8 |
| Trans | 36 | 20 | 55.6 | 21 | 58.3 | 12 | 33.3 | 13 | 36.1 | 5 | 13.9 | - | - |
| Textiles | 4 | - | - | - | - | - | - | - | - | - | - | - | - |
| Utilities | 68 | 28 | 41.2 | 23 | 33.8 | 20 | 29.4 | 11 | 16.2 | - | - | - | - |
| Wholesale | 47 | 19 | 40.4 | 21 | 44.7 | 13 | 27.7 | 17 | 36.2 | 7 | 14.9 | - | - |
| Total | 1,500 | 712 | 47.5 | 663 | 44.2 | 482 | 32.1 | 428 | 28.5 | 157 | 10.5 | 83 | 5.5 |

**TABLE 1 (continued)**
**Panel B: Types of Investor-Focused Corporate Announcements on Twitter**

| Type of Announcements | Unique Firms | % of Twitter Firms | Number of Tweets |
|---|---|---|---|
| Earnings | 406 | 57.0 | 2,205 |
| Preview Earnings | 273 | 38.3 | 1,189 |
| Rehash Earnings | 253 | 35.5 | 643 |
| Executive Turnover | 123 | 17.3 | 269 |
| Dividends | 98 | 13.8 | 324 |
| Board of Directors Change | 57 | 8.0 | 88 |
| New Product | 51 | 7.2 | 151 |
| M&A Transaction | 31 | 4.4 | 46 |
| Share Repurchases | 30 | 4.2 | 37 |
| New Investment | 20 | 2.8 | 32 |
| New Customer | 5 | 0.7 | 18 |

**Panel C: Firms and Industries that Tweet Earnings-Related Announcements on Twitter**

| Industry | EA Tweets Unique Firms | EA Tweets % of Twitter Firms | Preview Tweets Unique Firms | Preview Tweets % of Twitter Firms | Rehash Tweets Unique Firms | Rehash Tweets % of Twitter Firms |
|---|---|---|---|---|---|---|
| Autos | 2 | 33.3 | 1 | 16.7 | 1 | 16.7 |
| Beer | 3 | 75.0 | 1 | 25.0 | - | - |
| Books | 6 | 85.7 | 4 | 57.1 | 4 | 57.1 |
| Bus. Equip. | 69 | 67.0 | 53 | 51.5 | 47 | 45.6 |
| Carry | 4 | 80.0 | 4 | 80.0 | 2 | 40.0 |
| Chemicals | 8 | 53.3 | 6 | 40.0 | 7 | 46.7 |
| Clothing | 3 | 23.1 | 2 | 15.4 | 1 | 7.7 |
| Construction | 8 | 47.1 | 5 | 29.4 | 5 | 29.4 |
| Coal | 2 | 66.7 | 1 | 33.3 | - | - |
| Electronics | 5 | 71.4 | 5 | 71.4 | 2 | 28.6 |
| Fab. Prods. | 20 | 90.9 | 14 | 63.6 | 15 | 68.2 |
| Financials | 71 | 63.4 | 36 | 32.1 | 43 | 38.4 |
| Food | 8 | 50.0 | 5 | 31.3 | 4 | 25.0 |
| Games | 3 | 25.0 | 2 | 16.7 | 2 | 16.7 |
| Health | 27 | 73.0 | 18 | 48.6 | 14 | 37.8 |
| Household | 3 | 27.3 | 3 | 27.3 | 1 | 9.1 |
| Meals | 1 | 5.6 | 1 | 5.6 | - | - |
| Mines | 3 | 100.0 | 3 | 100.0 | 3 | 100.0 |
| Oil | 13 | 92.9 | 11 | 78.6 | 11 | 78.6 |
| Other | 8 | 57.1 | 7 | 50.0 | 7 | 50.0 |
| Paper | 5 | 50.0 | 4 | 40.0 | 2 | 20.0 |
| Retail | 10 | 16.4 | 4 | 6.6 | 6 | 9.8 |
| Services | 66 | 62.3 | 41 | 38.7 | 42 | 39.6 |
| Smoke | 1 | 100.0 | 1 | 100.0 | 1 | 100.0 |
| Steel | 3 | 100.0 | 3 | 100.0 | 3 | 100.0 |
| Telecom | 12 | 48.0 | 8 | 32.0 | 9 | 36.0 |
| Trans | 11 | 55.0 | 6 | 30.0 | 6 | 30.0 |
| Textiles | - | - | - | - | - | - |
| Utilities | 20 | 71.4 | 17 | 60.7 | 10 | 35.7 |
| Wholesale | 11 | 57.9 | 7 | 36.8 | 5 | 26.3 |
| Total | 406 | 57.0 | 273 | 38.3 | 253 | 35.5 |

**TABLE 1 (continued)**

**Panel D: Breakdown of Firms by their Consistency in Disseminating Earnings News using Twitter**

| Number of EA Tweets | Regular Firm | | Start-Stop Firm | | Sporadic Firm | |
|---|---|---|---|---|---|---|
| | Unique Firms | % of Twitter EA Firms | Unique Firms | % of Twitter EA Firms | Unique Firms | % of Twitter EA Firms |
| 1 | 17 | 4.2 | 58 | 14.3 | - | - |
| 2 | 11 | 2.7 | 10 | 2.5 | 20 | 4.9 |
| 3 | 16 | 3.9 | 5 | 1.2 | 19 | 4.7 |
| 4 | 8 | 2.0 | 7 | 1.7 | 19 | 4.7 |
| 5 | 17 | 4.2 | 1 | 0.2 | 17 | 4.2 |
| 6 | 5 | 1.2 | 5 | 1.2 | 17 | 4.2 |
| 7 | 9 | 2.2 | 3 | 0.7 | 20 | 4.9 |
| 8 | 8 | 2.0 | 2 | 0.5 | 16 | 3.9 |
| 9 | 2 | 0.5 | 1 | 0.2 | 11 | 2.7 |
| 10 | 4 | 1.0 | 1 | 0.2 | 12 | 3.0 |
| 11 | 3 | 0.7 | 1 | 0.2 | 13 | 3.2 |
| 12 | 7 | 1.7 | 58 | 14.3 | 15 | 3.7 |
| 13 | 21 | 5.2 | 10 | 2.5 | 1 | 0.2 |
| 14 | 4 | 1.0 | - | - | - | - |
| Total | 132 | 32.5 | 94 | 23.2 | 180 | 44.3 |

Table 1 presents summary statistics of the sample firms, which were members of the S&P 1500 index as of January 2013. Panel A shows adoption by firms, grouped within Fama-French 30 industries, across six popular social media platforms. Panel B shows the most frequently tweeted types of investor-focused corporate announcements on Twitter. Panel C shows the number of Twitter firms (those that have adopted Twitter), grouped with Fama-French 30 industries, which tweet three types of earnings-related announcements: 1) those sent on the earnings announcement date ("EA tweets"), 2) those sent in advance to remind investors of upcoming earnings announcements ("preview tweets"), and 3) those that call attention to a recent earnings announcement ("rehash tweets"). We classify earnings-related tweets to be preview, EA, or rehash if they occur within window (−30, −1), (0), or (+1, +10), respectively, with day 0 being the earnings announcement date. Panel D shows three categories of firms: 1) "Regular Firms" tweeted earnings news each and every quarter after the first time, 2) "Start-Stop Firms" tweeted earnings news for one or more quarters and then stopped, and 3) "Sporadic Firms" tweeted earnings news in some quarters but not others in an apparent ad hoc manner.

**TABLE 2: Twitter Usage in General and for Earnings News**

| Dependent Variable: | Indicator for Firm using Twitter (*TW*) | Indicator for Firm using Twitter for Earnings Tweets at least once (*TW_EA*) | |
|---|---|---|---|
| Sample | Full Sample (1) | Full Sample (2) | Twitter Sample (*TW*=1) (3) |
| *PRESS_RELEASES* | 0.561 *** | 0.374 *** | 0.265 *** |
| | (7.84) | (5.91) | (3.01) |
| *MEDIA_NEWS* | −0.345 *** | −0.315 *** | −0.202 ** |
| | (−7.33) | (−5.56) | (−2.49) |
| *SIZE* | 0.066 ** | 0.132 *** | 0.210 *** |
| | (2.08) | (3.95) | (4.16) |
| *MTB* | 0.025 * | 0.018 | 0.022 |
| | (1.68) | (1.14) | (1.02) |
| *ROA* | 2.534 | 3.236 | 1.988 |
| | (1.32) | (1.56) | (0.64) |
| *GROWTH* | 0.102 | −0.220 | −0.386 |
| | (0.51) | (−1.05) | (−1.23) |
| *LEVERAGE* | −0.575 ** | −0.336 | −0.156 |
| | (−2.46) | (−1.34) | (−0.44) |
| *ANALYSTS* | 0.268 *** | 0.096 | 0.037 |
| | (3.68) | (1.26) | (0.32) |
| *ADVERTISING* | 6.224 *** | −0.265 | −4.359 ** |
| | (4.25) | (−0.17) | (−2.00) |
| *FIRMAGE* | −0.000 | 0.000 | −0.001 |
| | (−0.02) | (0.12) | (−0.92) |
| *SILICON* | 0.024 | 0.018 | 0.027 |
| | (0.15) | (0.12) | (0.14) |
| *CEOAGE* | −0.019 *** | −0.014 ** | −0.006 |
| | (−3.77) | (−2.53) | (−0.73) |
| *FIRM_FOLLOWERS* | | | −0.136 *** |
| | | | (−3.93) |
| Industry F.E. | Included | Included | Included |
| N | 1,422 | 1,422 | 642 |
| Pseudo $R^2$ | 0.126 | 0.092 | 0.130 |

Table 2 reports results of firm-level probit regressions that test for the determinants of Twitter usage in general and for earnings news. Column (1) reports estimated coefficients and *z*-statistics (in parentheses) from regressing *TW*, an indicator variable set to 1 (0 otherwise) if a firm had a Twitter account, on a firm's traditional media attention and other firm characteristics. Columns (2) and (3) report estimated coefficients and *z*-statistics from regressing *TW_EA*, an indicator variable set to 1 (0 otherwise) if a firm tweeted earnings information at least once during our sample period, on the firm's traditional media attention, other firm characteristics, and the size of a firm's Twitter following. The independent variables are measured at the firm-level using either: 1) the first quarter in our sample period if the firm had a Twitter account at the beginning of our sample period, 2) the last quarter before the firm initiated its first tweet if the firm opened a Twitter account during our sample period, or 3) the last available quarter in our sample period if the firm did not have a Twitter account at the end of our sample period. *MEDIA_NEWS* is the log of one plus the number of news articles written by traditional media organizations about the firm (column 1) or the firm's earnings announcement (columns 2 and 3). All other variables are defined in Appendix A. We include industry fixed effects (Fama-French 10) but do not report the coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels using a two-sided *t*-test.

**TABLE 3: Quarter-by-Quarter Dissemination of Earnings News Using Twitter**
**Panel A: Descriptive Statistics of the Variables used in the Panel Regressions**

| Variables (N = 18,706) | Mean | Std. Dev. | Min | Q1 | Med. | Q3 | Max |
|---|---|---|---|---|---|---|---|
| *Twitter Variables* | | | | | | | |
| TW_EA_Q (Indicator) | 0.118 | 0.323 | | | | | |
| TW_EA_NUM | 0.077 | 0.294 | 0.000 | 0.000 | 0.000 | 0.000 | 3.829 |
| TW_EA_NUMPREVIEW | 0.040 | 0.172 | 0.000 | 0.000 | 0.000 | 0.000 | 2.197 |
| TW_EA_NUMREHASH | 0.027 | 0.169 | 0.000 | 0.000 | 0.000 | 0.000 | 3.689 |
| FIRM_FOLLOWERS | 4.017 | 4.450 | 0.000 | 0.000 | 0.000 | 8.106 | 15.674 |
| EA_RETWEETS | 0.038 | 0.241 | 0.000 | 0.000 | 0.000 | 0.000 | 4.369 |
| RETWEET_FOLLOWERS | 0.225 | 1.278 | 0.000 | 0.000 | 0.000 | 0.000 | 12.932 |
| *Traditional Media Variables* | | | | | | | |
| PRESS_RELEASES | 1.702 | 0.759 | 0.000 | 1.386 | 1.609 | 2.197 | 5.568 |
| MEDIA_NEWS | 2.495 | 0.900 | 0.000 | 1.946 | 2.565 | 3.045 | 5.513 |
| EA_NEWS | 2.178 | 1.075 | 0.000 | 1.792 | 2.398 | 2.833 | 5.347 |
| EA_NEWS_POS | 0.737 | 1.099 | 0.000 | 0.000 | 0.000 | 1.609 | 5.050 |
| EA_NEWS_NEG | 0.220 | 0.660 | 0.000 | 0.000 | 0.000 | 0.000 | 4.970 |
| *Market Reaction Variables* | | | | | | | |
| ABN_SAR | 4.024 | 5.219 | −2.886 | 0.254 | 2.688 | 6.392 | 23.429 |
| ABN_TURN | 1.895 | 0.966 | 0.578 | 1.251 | 1.652 | 2.267 | 6.034 |
| ABN_SPREAD | 0.764 | 3.732 | −8.543 | −0.746 | 0.040 | 1.468 | 20.042 |
| *Firm Characteristics* | | | | | | | |
| MISSEST (Indicator) | 0.266 | 0.442 | | | | | |
| EARNINGS_SURPRISE | 0.001 | 0.006 | −0.038 | 0.000 | 0.001 | 0.002 | 0.025 |
| \|EARNINGS_SURPRISE\| | 0.003 | 0.007 | 0.000 | 0.001 | 0.001 | 0.003 | 0.059 |
| SIZE | 8.049 | 1.699 | 2.793 | 6.789 | 7.919 | 9.104 | 14.687 |
| MTB | 2.729 | 2.524 | 0.506 | 1.302 | 1.973 | 3.123 | 17.505 |
| ROA | 0.014 | 0.019 | −0.089 | 0.004 | 0.012 | 0.023 | 0.079 |
| GROWTH | 0.059 | 0.185 | −1.050 | −0.011 | 0.065 | 0.147 | 0.538 |
| LEVERAGE | 0.201 | 0.169 | 0.000 | 0.051 | 0.180 | 0.311 | 0.717 |
| ANALYSTS | 2.332 | 0.658 | 0.693 | 1.792 | 2.398 | 2.833 | 3.951 |
| ADVERTISING | 0.011 | 0.027 | 0.000 | 0.000 | 0.000 | 0.010 | 0.365 |
| FIRMAGE | 56.984 | 44.353 | −4.000 | 23.000 | 41.000 | 87.000 | 268.000 |
| SILICON (Indicator) | 0.070 | 0.255 | | | | | |
| CEOAGE | 56.108 | 7.149 | 31.000 | 51.000 | 56.000 | 61.000 | 75.000 |

**TABLE 3 (continued)**
**Panel B: Regressions of Earnings Announcement Tweets on the Direction of Earnings News**

| Dependent Variable: | | Indicator for Firm making an EA Tweet in Quarter q (*TW_EA_Q*) | | Log Number of EA Tweets in Quarter q (*TW_EA_NUM*) | |
|---|---|---|---|---|---|
| Sample | Pred. | Full Sample | Twitter EA Sample (*TW_EA=1*) | Full Sample | Twitter EA Sample (*TW_EA=1*) |
| | | (1) | (2) | (3) | (4) |
| MISSEST | − | −0.083 ** | −0.118 ** | −0.010 * | −0.038 * |
| | | (−2.36) | (−2.14) | (−1.70) | (−1.60) |
| \|EARNINGS_SURPRISE\| | | −0.181 | 2.370 | 0.158 | 0.459 |
| | | (−0.04) | (0.39) | (0.29) | (0.18) |
| MISSEST | − | −9.218 ** | −11.935 * | −0.572 | −2.013 |
| *\|EARNINGS_SURPRISE\| | | (−2.08) | (−1.87) | (−1.07) | (−0.83) |
| PRESS_RELEASES | | 0.116 ** | 0.041 | 0.016 ** | 0.006 |
| | | (2.55) | (0.68) | (2.16) | (0.20) |
| MEDIA_NEWS | | 0.011 | 0.043 | 0.001 | 0.012 |
| | | (0.24) | (0.78) | (0.08) | (0.45) |
| SIZE | | 0.145 *** | 0.120 *** | 0.026 *** | 0.045 ** |
| | | (4.85) | (3.15) | (5.05) | (2.58) |
| MTB | | 0.039 *** | 0.018 | 0.007 * | 0.008 |
| | | (3.04) | (1.01) | (1.87) | (0.84) |
| ROA | | 0.623 | 2.328 | −0.103 | −0.453 |
| | | (0.43) | (1.20) | (−0.43) | (−0.53) |
| GROWTH | | 0.049 | 0.176 | −0.026 | −0.064 |
| | | (0.41) | (1.03) | (−1.21) | (−0.71) |
| LEVERAGE | | −0.108 | 0.113 | 0.001 | 0.150 |
| | | (−0.49) | (0.35) | (0.05) | (1.10) |
| ANALYSTS | | 0.017 | −0.070 | −0.003 | −0.018 |
| | | (0.26) | (−0.79) | (−0.37) | (−0.53) |
| ADVERTISING | | −2.318 | −0.989 | 0.213 | 1.927 |
| | | (−1.61) | (−0.39) | (0.92) | (1.19) |
| FIRMAGE | | 0.000 | 0.000 | 0.000 | 0.000 |
| | | (0.05) | (0.18) | (0.23) | (0.46) |
| SILICON | | 0.076 | 0.033 | 0.004 | −0.017 |
| | | (0.57) | (0.23) | (0.16) | (−0.24) |
| CEOAGE | | −0.003 | 0.012 ** | −0.001 | 0.001 |
| | | (−0.62) | (2.02) | (−1.09) | (0.37) |
| Industry & Quarter F.E. | | Included | Included | Included | Included |
| N | | 18,706 | 3,952 | 18,706 | 3,952 |
| Pseudo $R^2$ (Probit) or $R^2$ (OLS) | | 0.090 | 0.041 | 0.056 | 0.082 |

**TABLE 3 (continued)**

Table 3 presents descriptive statistics and results from regressions of firms' choice to disseminate earnings announcement tweets over Twitter each quarter. Panel A shows descriptive statistics of the variables used in the panel regressions. The sample comprises a maximum of 18,706 firm-quarter observations for the S&P 1500 firms between 1Q2010 and 1Q2013 for which sufficient Compustat financial data, CRSP stock price data, and I/B/E/S analyst forecast data exist. We eliminate firm-quarters with negative shareholders' equity. All variables are defined in Appendix A. Except for variables with natural lower or upper bounds, variables are winsorized at the 1st and 99th percentiles. In Panel B, Columns (1) and (2) report probit coefficient estimates and $z$-statistics (in parentheses), based on standard errors clustered by firm, from regressing $TW\_EA\_Q_{i,q}$ on the firm's quarterly earnings characteristics, traditional media attention, and other firm characteristics. $TW\_EA\_Q_{i,q}$ is an indicator variable set to 1 (0 otherwise) if firm $i$ disseminated at least one EA tweet for fiscal quarter $q$. Columns (3) and (4) report the results of OLS regressions in which the dependent variable is $TW\_EA\_NUM_{i,q}$, defined as the log of one plus the number of EA tweets that firm $i$ made for fiscal quarter $q$. All other variables are defined in Appendix A. We include industry (Fama-French 10) and quarter-fixed effects in the regressions but do not report the coefficients. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels using a two-tailed $t$-test.

**TABLE 4: Response by Firms' Twitter Followers to Earnings Tweets**

| Dependent Variable: | EA_RETWEETS | RETWEETS_ FOLLOWERS |
|---|---|---|
| | (1) | (2) |
| MISSEST | −0.004 | −0.078 |
| | (−0.14) | (−0.48) |
| \|EARNINGS_SURPRISE\| | −1.501 | −8.627 |
| | (−0.35) | (−0.40) |
| MISSEST*\|EARNINGS_SURPRISE\| | 0.743 | 5.612 |
| | (0.19) | (0.28) |
| PRESS_RELEASES | 0.046 | 0.109 |
| | (1.37) | (0.63) |
| MEDIA_NEWS | 0.005 | −0.016 |
| | (0.18) | (−0.10) |
| SIZE | 0.128 *** | 0.552 *** |
| | (5.71) | (5.07) |
| MTB | 0.024 ** | 0.113 ** |
| | (2.50) | (2.37) |
| ROA | 1.023 | 2.530 |
| | (0.93) | (0.46) |
| GROWTH | 0.116 | 0.229 |
| | (1.22) | (0.49) |
| LEVERAGE | −0.134 | −0.742 |
| | (−0.75) | (−0.82) |
| ANALYSTS | −0.040 | −0.098 |
| | (−0.93) | (−0.40) |
| ADVERTISING | −0.770 | −6.893 |
| | (−0.73) | (−1.33) |
| FIRMAGE | 0.000 | 0.003 |
| | (0.52) | (0.98) |
| SILICON | 0.150 | 0.354 |
| | (1.56) | (0.81) |
| CEOAGE | −0.003 | −0.005 |
| | (−0.86) | (−0.33) |
| Industry & Quarter F.E. | Included | Included |
| N | 2,205 | 2,205 |
| R-squared | 0.199 | 0.152 |

Table 4 reports OLS coefficient estimates and *t*-statistics (in parentheses), based on standard errors clustered by firm, from regressing a Twitter follower response variable on the firm's quarterly earnings characteristics, traditional media attention, and other firm characteristics. The Twitter response variable is the log of one plus the number of retweets per EA tweet (*EA_RETWEETS*) in Column (1) and the log of the total followers of all retweeters (*RETWEET_FOLLOWERS*) in Column (2). All other variables are defined in Appendix A. We include industry (Fama-French 10) and quarter-fixed effects in the regressions but do not report the coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels using a two-tailed *t*-test.

**TABLE 5: Association between Earnings Tweets and Traditional Media**

| Dependent Variable: | EA_NEWS | EA_NEWS_POS | EA_NEWS_NEG |
|---|---|---|---|
| | **(1)** | **(2)** | **(3)** |
| RETWEET_FOLLOWERS | 0.005 | 0.006 | −0.003 |
| | (0.51) | (0.51) | (−0.44) |
| RETWEET_FOLLOWERS | 0.009 | −0.004 | 0.032 * |
| * MISSEST | (0.56) | (−0.19) | (1.76) |
| EA_FIRM_FOLLOWERS | 0.010 | 0.003 | 0.004 |
| | (1.64) | (0.70) | (1.32) |
| SIZE | 0.215 *** | 0.118 *** | 0.052 *** |
| | (13.04) | (11.21) | (7.08) |
| MTB | 0.030 *** | 0.027 *** | 0.012 *** |
| | (4.79) | (4.84) | (3.96) |
| ROA | 2.469 *** | 6.180 *** | −3.951 *** |
| | (3.81) | (10.75) | (−9.68) |
| GROWTH | −0.157 *** | 0.426 *** | −0.348 *** |
| | (−2.80) | (8.22) | (−8.95) |
| LEVERAGE | −0.210 * | −0.132 * | −0.112 *** |
| | (−1.94) | (−1.76) | (−2.63) |
| ANALYSTS | 0.244 *** | 0.166 *** | 0.067 *** |
| | (8.24) | (8.34) | (4.80) |
| MISSEST | −0.029 | −0.277 *** | 0.197 *** |
| | (−1.54) | (−16.16) | (13.42) |
| \|EARNINGS_SURPRISE\| | 2.230 | 2.418 ** | 5.875 *** |
| | (1.05) | (2.10) | (5.14) |
| Industry & Quarter F.E. | Included | Included | Included |
| N | 18,706 | 18,706 | 18,706 |
| R-squared | 0.260 | 0.128 | 0.090 |

Table 5 reports OLS coefficient estimates and $t$-statistics (in parentheses), based on standard errors clustered by firm, from regressing a traditional media news variable on variables capturing Twitter dissemination and audience size. *EA_NEWS* is the log of one plus the number of news articles written by traditional media organizations about the firm during the three-day window centered on the firm's earnings announcement date. We also partition the log number of news articles into positive (*EA_NEWS_POS*) and negative (*EA_NEWS_NEG*) news. *RETWEET_FOLLOWERS* is the log of one plus the total number of followers of users who retweeted a firm's EA tweet. All other variables are defined in Appendix A. We include industry (Fama-French 10) and quarter-fixed effects in the regressions but do not report the coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels using a two-tailed $t$-test.

**TABLE 6: Association between Earnings Tweets and Market Reactions**

| Dependent Variable: | ABN_SAR | | ABN_TURN | | ABN_SPREAD | |
|---|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** |
| EA_FIRM_FOLLOWERS | 0.039 * | 0.040 * | 0.002 | 0.002 | −0.022 *** | −0.022 *** |
| | (1.89) | (1.92) | (0.58) | (0.68) | (−2.72) | (−2.76) |
| RETWEET_FOLLOWERS | 0.008 | 0.011 | 0.002 | 0.003 | 0.033 ** | 0.037 ** |
| | (0.21) | (0.27) | (0.31) | (0.46) | (2.08) | (2.29) |
| EA_FIRM_FOLLOWERS * | | 1.628 | | 0.462 | | −0.736 |
| \|EARNINGS_SURPRISE\| | | (0.54) | | (0.96) | | (−0.67) |
| RETWEET_FOLLOWERS * | | 2.645 | | 0.857 | | 5.322 * |
| \|EARNINGS_SURPRISE\| | | (0.28) | | (0.77) | | (1.86) |
| \|EARNINGS_SURPRISE\| | 28.454 *** | 29.225 *** | 14.216 *** | 14.445 *** | 3.300 | 3.560 |
| | (3.43) | (3.48) | (8.69) | (8.88) | (0.58) | (0.65) |
| MISSEST | 0.680 *** | 0.681 *** | 0.203 *** | 0.203 *** | 0.057 | 0.057 |
| | (7.23) | (7.24) | (11.13) | (11.13) | (0.88) | (0.88) |
| MEDIA_NEWS | 0.250 *** | 0.249 *** | 0.086 *** | 0.086 *** | 0.000 | 0.000 |
| | (3.70) | (3.68) | (6.15) | (6.12) | (0.00) | (0.01) |
| SIZE | −0.368 *** | −0.368 *** | −0.149 *** | −0.149 *** | −0.190 *** | −0.190 *** |
| | (−8.39) | (−8.39) | (−15.63) | (−15.65) | (−6.89) | (−6.87) |
| MTB | 0.005 | 0.006 | 0.001 | 0.001 | 0.009 | 0.009 |
| | (0.23) | (0.25) | (0.24) | (0.26) | (0.67) | (0.67) |
| ROA | 7.709 *** | 7.623 *** | 1.501 ** | 1.475 ** | −3.206 | −3.233 |
| | (2.69) | (2.64) | (2.45) | (2.41) | (−1.53) | (−1.54) |
| GROWTH | 0.739 *** | 0.737 *** | 0.274 *** | 0.274 *** | 0.226 | 0.229 |
| | (3.25) | (3.25) | (5.97) | (5.99) | (1.28) | (1.29) |
| LEVERAGE | −1.041 *** | −1.047 *** | −0.090 | −0.092 | −0.942 *** | −0.945 *** |
| | (−2.99) | (−3.01) | (−1.30) | (−1.32) | (−4.50) | (−4.50) |
| ANALYSTS | 0.686 *** | 0.686 *** | 0.340 *** | 0.340 *** | −0.272 *** | −0.272 *** |
| | (6.47) | (6.47) | (16.77) | (16.76) | (−3.94) | (−3.95) |
| Industry & Quarter F.E. | Included | Included | Included | Included | Included | Included |
| N | 18,706 | 18,706 | 18,706 | 18,706 | 18,706 | 18,706 |
| R-squared | 0.073 | 0.073 | 0.159 | 0.160 | 0.030 | 0.030 |

Table 6 reports OLS coefficient estimates and *t*-statistics (in parentheses), based on standard errors clustered by firm, from regressing the market reaction variables on variables capturing Twitter dissemination audience size. *ABN_SAR* is abnormal absolute size-adjusted return, *ABN_TURN* is abnormal volume turnover, and *ABN_SPREAD* is abnormal bid-ask spread. Each variable is measured over a three-day window centered on a firm's earnings announcement date. These and all other variables are defined in Appendix A. We include industry (Fama-French 10) and quarter-fixed effects in the regressions but do not report the coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels using a two-tailed *t*-test.

**TABLE 7: Quarter-by-Quarter Dissemination of Preview and Rehash Tweets**

| Dependent Variable: | Number of Preview Tweets (*TW_EA_NUMPREVIEW*) | | Number of Rehash Tweets (*TW_EA_NUMREHASH*) | |
| --- | --- | --- | --- | --- |
| | | Twitter EA Sample (*TW_EA*=1) | | Twitter EA Sample (*TW_EA*=1) |
| Sample: | Full Sample | | Full Sample | |
| | (1) | (2) | (3) | (4) |
| *MISSEST* | 0.002 | 0.016 | −0.002 | −0.008 |
| | (0.59) | (1.05) | (−0.78) | (−0.54) |
| *|EARNINGS_SURPRISE|* | −0.177 | −0.869 | 0.676 | 3.269 |
| | (−0.84) | (−0.81) | (1.54) | (1.41) |
| *MISSEST*|EARNINGS_SURPRISE|* | −0.239 | −0.759 | −0.851 * | −3.589 * |
| | (−0.95) | (−0.64) | (−1.93) | (−1.67) |
| *PRESS_RELEASES* | 0.013 *** | 0.017 | 0.007 * | 0.004 |
| | (2.71) | (1.04) | (1.72) | (0.22) |
| *MEDIA_NEWS* | −0.000 | −0.000 | 0.003 | 0.014 |
| | (−0.12) | (−0.02) | (0.85) | (0.86) |
| *SIZE* | 0.007 ** | 0.002 | 0.007 *** | 0.016 |
| | (2.55) | (0.17) | (2.63) | (1.50) |
| *MTB* | 0.001 | −0.004 | 0.003 | 0.005 |
| | (0.74) | (−0.83) | (1.34) | (0.78) |
| *ROA* | 0.003 | 0.021 | −0.168 | −0.850 |
| | (0.03) | (0.05) | (−1.29) | (−1.49) |
| *GROWTH* | −0.002 | 0.011 | −0.004 | 0.003 |
| | (−0.21) | (0.24) | (−0.33) | (0.06) |
| *LEVERAGE* | 0.009 | 0.119 | −0.005 | 0.055 |
| | (0.51) | (1.57) | (−0.27) | (0.67) |
| *ANALYSTS* | 0.004 | 0.002 | −0.000 | −0.015 |
| | (0.67) | (0.09) | (−0.10) | (−0.69) |
| *ADVERTISING* | −0.059 | −0.138 | −0.136 ** | −0.887 ** |
| | (−0.59) | (−0.18) | (−2.50) | (−2.24) |
| *FIRMAGE* | −0.000 | 0.000 | −0.000 | −0.000 |
| | (−0.23) | (0.05) | (−0.38) | (−0.57) |
| *SILICON* | −0.011 | −0.045 | 0.004 | −0.002 |
| | (−0.77) | (−1.17) | (0.34) | (−0.07) |
| *CEOAGE* | 0.000 | 0.003 ** | −0.000 | 0.001 |
| | (0.39) | (2.18) | (−0.42) | (0.80) |
| Industry & Quarter F.E. | Included | Included | Included | Included |
| N | 18,706 | 3,952 | 18,706 | 3,952 |
| R-squared | 0.028 | 0.037 | 0.019 | 0.034 |

Table 7 reports the results of OLS regressions in which the dependent variable is *TW_EA_NUMPREVIEW* or *TW_EA_NUMREHASH,* defined as one plus the log of the number of preview and rehash tweets, respectively, sent by a company each quarter. All other variables are defined in Appendix A. We include industry (Fama-French 10) and quarter-fixed effects in the regressions but do not report the coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels using a two-sided *t*-test.