

# *The unintended consequence of social media criticisms: an earnings management perspective*

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# The unintended consequence of social media criticisms: an earnings management perspective

Yi Li<sup>a,b</sup>, Wei Zhang<sup>a</sup>, Andrew Urquhart<sup>c</sup> and Pengfei Wang<sup>a</sup>

<sup>a</sup>College of Management and Economics, Tianjin University, People's Republic of China; <sup>b</sup>School of Management and Economics, Beijing Institute of Technology, Beijing, People's Republic of China; <sup>c</sup>ICMA Centre, Henley Business School, University of Reading, Reading, UK

## ABSTRACT

This paper investigates the impact of social media criticisms on financial reporting quality. Analyzing data from the leading Internet stock message board in China, we demonstrate that postings on stock message boards could promote earnings management, i.e. reducing financial transparency. This finding is further enhanced by employing the instrumental variable approach and the difference-in-differences approach and is explained by the cognitive evaluation theory. Additional analysis suggests that the positive relation between social media criticisms and earnings management cannot be attributed to a deterioration in operating performance or internal governance and is more pronounced in postings from senior users.

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## 1. Introduction

The past few decades have witnessed dramatic changes in how information is disseminated in financial markets. As an important platform for communicating financial news, social media tends to be a blessing, especially for individual investors (Antweiler and Frank 2004; Das and Chen 2007; Park et al. 2013), who otherwise might not have access to comprehensive information about stocks and speaking up for themselves. Ang et al. (2021) have demonstrated that individual investors could protect their own interests by expressing their opposition to firms' acquisition proposals on social media. However, investors' social media criticisms could also have some unexpected effects. In this paper, we try to shed light on the potential dark side of social media criticisms by investigating how they influence firms' earnings management.

Earnings management is typically deemed as an inappropriate (Xie, Davidson III, and DaDalt 2003) or even unethical behavior (Du et al. 2015) and is one of the most provocative topics in both finance and accounting, especially in the last few decades. Investors' social media criticisms of firm fundamentals can deter earnings management. Both anecdotal and academic evidence indicates that social media could act as an effective part of the external governance mechanism. Specifically, social media is useful in bringing corporate fraud to light. Although the Enron scandal was publicized in October 2001, messages posted on Yahoo! Finance had started to question the company's accounting data, criticized its corporate culture, and warned investors to sell its stocks since 1997. As for China, the scandals of firms such as Longping High-Tech and Fasten Group were first widely spread on Internet stock message boards and then followed by media. Also, previous research has demonstrated that social media could constrain firms' behaviors. For example, Dube and Zhu (2021) find that after being reviewed on Glassdoor, firms enhance their workplace practices; Ang et al. (2021) document a positive relation between investors' negative postings and firms' propensity to withdraw their value-destroying acquisition

**CONTACT** Andrew Urquhart  a.j.urquhart@icmacentre.ac.uk

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attempts. Considering that better external governance leaves managers with fewer opportunities to engage in financial misconduct (Ndofor, Wesley, and Priem 2015), we expect that there is a negative relation between investors' social media criticisms and firms' earnings manipulation.

On the other hand, investors' social media criticisms of firm fundamentals could reduce earnings quality. In the framework of cognitive evaluation theory (Deci 1971), external monitoring could crowd out managers' intrinsic motivation to behave ethically. Aligned with this theory, Shi, Connelly, and Hoskisson (2017) show that powerful expectations from outsiders such as activist owners and securities analysts can impinge on top managers' feelings of autonomy and crowd out their intrinsic motivation, which may cause financial fraud. The cognitive evaluation theory could better fit our setting. First, most users of stock message boards are individual investors, who are more myopic and less sophisticated (Barber and Odean 2000; Barber et al. 2009) than institutional investors. Second, compared to financial fraud, earnings management is more subtle and more legally acceptable but could similarly mislead investors about the firm's true underlying economic performance (Lo 2008). Taken together, it is likely that when executives feel pressure from investors' social media criticisms of their firms' fundamentals, they choose to manipulate earnings.

We consider China a unique environment to explore how investors' social media criticisms affect firms' earnings management. In spite of its rapid growth and increasing importance, the Chinese stock market is still an emerging one. Because of the weak institutional environment (Allen, Qian, and Qian 2005), Chinese listed firms are plagued by serious agency problems (Zhang 2018b), including earnings management (Chen and Yuan 2004; Jiang, Lee, and Yue 2010a). Another distinctive feature of the Chinese stock market is the excessive dominance of retail investors, who face great difficulty gathering firm-specific information (Piotroski and Wong 2012). However, the boom of social media enables these investors to obtain information and communicate ideas via these new channels (Park et al. 2013), making Internet stock message boards particularly active in China (Huang, Qiu, and Wu 2016). Hence, the impact of stock message boards postings on earnings management may be easy to observe and valuable to study in the Chinese setting.

To analyze the impact of stock message board postings on earnings management, we collect all messages posted between 2010 and 2019 on the Guba EastMoney, the most popular Internet stock message board set in China.<sup>1</sup> Meanwhile, following common practice, we employ the absolute value of discretionary accruals as the main proxy for earnings management. We find a positive relation between the number of negative fundamental-related postings and discretionary accruals after controlling for other firm characteristics, indicating that social media criticisms promote managers' opportunistic earnings management behaviors.<sup>2</sup>

A major concern with the above results is that the relation between postings on stock message boards and firms' earnings management could be endogenously determined. Our findings could be driven by reverse causality, i.e. firms with serious earnings management are criticized more on stock message boards. For another, omitted variables could also bias the results, i.e. unobservable firm characteristics can correlate with both postings and earnings management. To address these concerns, we adopt three different strategies.

In the first strategy, we employ an instrumental variable based on a unique institutional feature of the Chinese stock market: daily price limits. In particular, the rule imposes daily price limits of 10% on regular stocks. According to prior studies such as Seasholes and Wu (2007) and Chen et al. (2019), stocks hitting price limits (i.e. price limit events) attract great investor attention because trading software and media reports always display those stocks. And common wisdom suggests that the more attention investors pay to a stock, the higher likelihood that investors find the firm's operational issues and criticize it for its fundamentals. Consequently, the number of price limit events for a stock should be positively correlated with the number of negative postings related to firm fundamentals on its stock message board. More importantly, Seasholes and Wu (2007) show that price limit events are generally followed by statistically significant price mean reversion. Put simply, the number of price limit events is not necessarily related to particularly good or bad stock price performance. Therefore, it is free of the concern that stock prices could affect managers' incentives for earnings management. As expected, the estimates from the two-stage least squares regressions with this instrumental variable support that social media criticisms encourage earnings management.

Regarding the second strategy, we use the difference-in-differences approach based on the launch of the mobile App for Guba EastMoney. The launch of the mobile App is a good candidate for the quasi-natural experiment for several reasons. First, because of the convenience of using mobile phones, the number of postings

(including negative fundamental-related postings) on stock message boards greatly rises after the launch of the mobile App (Jiang, Liu, and Yang 2019). And there is also variation in the increase of posting volume in the cross-section of stocks. Second, it is unlikely that the launch of the mobile App directly influences firms' earnings management since the launch of the mobile App is primarily due to the development of technology and the popularity of mobile phones. After undertaking a number of tests to check whether our sample satisfies the parallel-trend assumption, we find that firms who experience a significant increase in the number of negative postings related to firm fundamentals around the launch of the mobile App manage their earnings more seriously than those who do not.

The third strategy uses the change specification to revisit our main analysis. We find that changes in negative fundamental-related postings could positively predict changes in discretionary accruals in the next period while there is no significant relation between changes in discretionary accruals and the subsequent changes in negative fundamental-related postings.

Additionally, to ensure that our findings are not driven by methodological choices, we rerun the baseline regression with alternative measures for earnings management (including other measures for accrual-based earnings management and measures for real earnings management) and alternative measures for social media criticisms. In addition, to correct the potential bias inference due to the usage of the residuals as the dependent variable (Chen, Hribar, and Melessa 2018; Christodoulou, Ma, and Vasnev 2018), we take advantage of two approaches: estimating the coefficients for all independent variables (employed in the regression to obtain discretionary accruals and the baseline regression) in a single-step regression and regressing the discretionary accruals on the combination of all independent variables. The results remain intact with these robustness checks. We also explore whether our finding varies with the user level of postings.

Even if the aforementioned tests verify that individual investors' social media criticisms cause serious earnings management, this finding does not necessarily point to the cognitive evaluation theory, i.e. the excess pressure exerted by negative fundamental-related postings on stock message boards (or individual investors who use Internet stock message boards, to be concrete) subvert intrinsic motivation to act ethically. On the contrary, a large number of postings on stock message boards might simply signal deterioration in firms' internal governance and operating performance, which also elevates the chance of committing earnings management. Although the core idea of the cognitive evaluation theory is straightforward, it is unrealistic to test this theory directly due to the difficulties in measuring the stress managers feel. To surmount this challenge, we estimate the magnitude of incentives and restrictions faced by managers when manipulating earnings. The logic is that managers who have tighter constraints and weaker motivation to inflate or deflate earnings will be less affected by the pressure exerted by social media criticisms. Specifically, we employ the ownership structure and industry competition to measure managers' incentives to inflate or deflate earnings. Meanwhile, we utilize external governance and religious belief as two mechanisms constraining earnings management. Consistent with our expectations, we find that the positive link between social media criticisms and earnings management is more pronounced among firms who are privately owned, involved in fiercer competitions, less monitored, and less influenced by religion. Moreover, we rule out explanations associated with the deterioration in internal governance and operating performance with additional analyses.

Our contributions to the existing literature are mainly twofold. First, we broaden the investigation of social media's impact on financial markets. A large strand of literature has checked how social media content affects stock trading and price formation. They confirm that opinions transmitted through social media or online reviews contain valuable information that can elicit trading (Antweiler and Frank 2004) and predict both future stock returns and earnings surprises (Chen et al. 2014; Huang 2018; Green et al. 2019). They also demonstrate that information aggregation on social media can facilitate the incorporation of firm-specific information into stock prices (Ding, Zhou, and Li 2019; Feng and Johansson 2019). A nascent but growing literature examines the role of social media in corporate governance. So far, the consensus has been that social media could enhance corporate governance by offering investors and employees opportunities to express their dissatisfaction (Ang et al. 2021; Dube and Zhu 2021). However, by showing that postings on stock message boards can encourage earnings management, our paper points out an unintended consequence of social media criticisms, thereby offering novel evidence on an under-explored dark side of social media content — the detriment to financial reporting quality.<sup>3</sup>

In the meantime, we also add to a substantial body of work focusing on earnings management. Previous literature has demonstrated that in addition to executive characteristics and internal governance, forces outside of firms can influence how managers engage in wrongdoing. For instance, studies such as Hadani, Goranova, and Khan (2011) indicate that monitoring by institutional owners can constrain earnings management. This is especially so when the cost of acquiring monitoring information is low (Ayers, Ramalingegowda, and Yeung 2011). Yu (2008) finds that firms followed by more analysts tend to manage their earnings less. According to Dyck, Morse, and Zingales (2010), media, auditors, employees, and industry regulators also play a critical role in detecting corporate fraud. Besides, the financial misbehavior of firms also varies with social norms (Du et al. 2015; Parsons, Sulaeman, and Titman 2018), public governance (Zhang 2018a), and industry competition (Wang, Winton, and Yu 2010; Markarian and Santalo 2014). Our results suggest that negative fundamental-related postings on stock message boards are positively related to earnings management. Considering that most users of Internet stock message boards are individual investors, an interpretation of our findings is that individual investors have quite limited ability in corporate governance.

The remainder of this paper is organized as follows. Section 2 develops the main hypotheses. Section 3 presents the primary empirical findings. Section 4 examines the potential explanations. And Section 5 concludes the paper.

## 2. Hypothesis development

Previous literature has recognized the role of traditional media in corporate governance. Nevertheless, according to Miller and Skinner (2015), it is relatively unusual for conventional media to create content about firms. A vivid example is Miller (2006), who explored whether media can help identify fraud before firm announcements. He consulted press coverage for 17 years but only found 75 articles satisfying his requirement.

In recent years, the rapid proliferation and widespread adoption of social media have drastically transformed the information landscape by reshaping the ways information is produced, disseminated, and processed (Miller and Skinner 2015). Similar to traditional media, social media (i.e. Internet stock message boards in our case) can also improve corporate governance. First, social media provides a more accessible outlet for ordinary people, who generally have diverse backgrounds and different skills (Ang et al. 2021). The aggregation of opinions provided by these people may convey valuable information about firms' fundamentals or prospects that professionals do not possess (Chen et al. 2014). Hence, the development of social media could facilitate the information acquisition of individual investors and reduce their information disadvantage. More importantly, when facing firms' value-destroying activities, institutional investors can vote with their feet or directly talk to managers (Shleifer and Vishny 1997; La Porta et al. 2000). In contrast, individual investors used to have small market power. However, the rise of social media allows them to speak up for themselves, empowering them to exert influences on managers' decision-making (Ang et al. 2021). On the other hand, the arrival of social media could also trigger some unintended consequences. This is primarily because those engaged on social media are comparatively irrational and uninformed (Miller and Skinner 2015). As a result, social media could widen and accelerate the spread of falsehoods (Vosoughi, Roy, and Aral 2018) and act as a rumor mill (Jia et al. 2020).

As for earnings management, social media criticisms can either amplify or curb managers' opportunistic earnings manipulation behaviors. Since earnings management is always viewed as a potentially fraudulent activity (Lo 2008), we couch our hypotheses in the Fraud Triangle framework to facilitate and justify hypothesis development. This framework compasses pressure, opportunity, and rationalization (Schnatterly, Gangloff, and Tuschke 2018). Pressure, also known as incentives, reflects the necessity to commit misconduct. Opportunity suggests the remote likelihood of being caught and punished for wrongdoing. And rationalization is the ability to explain misconduct as morally justifiable and reduce the individual's cognitive dissonance.

Social media criticisms could affect the opportunity of earnings management. First, the extant literature has demonstrated that social media help expand the team of outside monitors by enabling individual investors and employees to engage in corporate governance. For example, Ang et al. (2021) capture a positive relation between small investors' negative postings towards a value-destroying acquisition proposal and the likelihood of the firm's future withdrawal of this acquisition attempt. Dube and Zhu (2021) document an increase in a firm's corporate social responsibility scores on employee relations and diversity after being reviewed on Glassdoor.



Second, online messages could increase the probability of being caught since they are useful for bringing corporate fraud to light. Although the Enron scandal was publicized in October 2001, messages posted on Yahoo! Finance had started to question its accounting data, criticized its corporate culture, and warned investors to sell its stocks since 1997. Before Muddy Water Research released a report concerning the fraud of NQ mobile (a Chinese company), an investor had submitted articles to a Chinese social media platform questioning the financial reports of NQ mobile. Motivated by these anecdotes, Dong, Liao, and Zhang (2018) design an algorithm to uncover fraud based on machine learning and signals (i.e. sentiment, topic, and social network) from social media.

Besides, it is widely recognized that social media plays an important role in improving the information environment in financial markets. In particular, Xu and Zhang (2013) point out information aggregation on Wikipedia can moderate the timing of managers' voluntary disclosure of bad news and investors' negative reaction to bad news. By analyzing articles from Seeking Alpha, Ding, Zhou, and Li (2019) find that financial analyses on Seeking Alpha mitigate stock return comovement. Since managers are more likely to manipulate earnings when there is a severe information asymmetry between firms and investors, social media can reduce the costs for outsiders to monitor firms' operations and managers' behaviors by impounding more firm-specific information into stock prices (Amiram et al. 2018). Taken together, social media could reduce the opportunity of misconduct by acting as an effective part of external governance, thereby deterring earnings management. We view this as the *curbing hypothesis*.

*H1a (curbing hypothesis): Investors' criticisms on stock message boards are negatively associated with firms' earnings management.*

However, social media criticisms could also influence the necessity of earnings manipulation. This is because negative postings on stock message boards could apply pressure to executives. By introducing the cognitive evaluation theory (Deci 1971) into the area of corporate governance, Shi, Connelly, and Hoskisson (2017) argue that despite its role in preventing managers from acting opportunistically, external governance could have the opposite of the intended effect. This is because the high expectations imposed by external governance can impinge on managers' feelings of autonomy and crowd out their intrinsic motivation, which potentially leads to financial fraud. They later demonstrate that the level of dedicated institutional ownership and analyst recommendation is positively associated with the likelihood of financial fraud for a firm.

The cognitive evaluation theory could also apply to the case of stock message board postings. First, investor expectations can be transmitted through stock message boards to managers. According to a report issued by the Shenzhen Stock Exchange,<sup>4</sup> managers pay great attention to postings on stock message boards. They respond quickly to rumors disseminated on stock message boards by making clarifications or answering questions. Some companies (e.g. Fujian Sangang Minguang Co., Ltd) even develop rules to standardize how to react to postings on Internet stock message boards. Besides, as mentioned earlier, most users of Internet stock message boards are individual investors, who are generally more myopic and less sophisticated (Barber and Odean 2000; Barber et al. 2009) than institutional investors. Meanwhile, the effective monitoring role of stock message boards should rely on the objectivity and authenticity of the information disseminated on them (Besley and Prat 2006). Both anecdotal<sup>5</sup> and academic (Clarke et al. 2020; Jia et al. 2020) evidence indicates that there are some falsehoods on social media for investors. Therefore, they might not act as an effective external governance mechanism (Bainbridge 2005) but push managers to manage earnings. Collectively, managers could engage more in earnings management under the pressure of investors' social media criticisms. This conjecture can be regarded as the *amplifying hypothesis*.

*H1b (amplifying hypothesis): Investors' criticisms on stock message boards are positively associated with firms' earnings management.*

### 3. Empirical results

This section introduces the data sample and the baseline analysis employed to investigate whether negative fundamental-related postings on stock message boards can promote or constrain earnings management.



### 3.1. Sample selection and variable definitions

Our message board data come from Guba EastMoney, one of the most popular stock message board sets in the world. We choose this Internet stock message board set for the following reasons. First, Guba EastMoney is the largest Internet stock message board set in China with a long history. It officially went online in January 2006 and covers more than 3,000 stocks now. Second, it is the most active and influential stock message board in China. When we search for ‘Internet stock message board’ in Baidu (the most popular search engine in China), Guba EastMoney always gets to the top of the search results. And till the end of 2019, more than 100 million messages have been posted on stock message boards of this set. More importantly, it has been employed as the main data source for many studies such as Hong et al. (2014), Huang, Qiu, and Wu (2016), and Jiang, Liu, and Yang (2019).

To collect messages posted on Guba EastMoney, we write a Web-scraping program to automatically download posting information, including the message content, users’ ID, commentaries, page views, etc. Our initial sample contains postings from 2010 to 2019.

For the purpose of this study, we employ a two-step procedure to extract the negative fundamental-related postings. In particular, we only include postings that contain at least one keyword related to firms’ investment and financing or firms’ accounting information,<sup>6</sup> to avoid the influence of noise on stock message boards. After that, we use Baidu Brain, a leading AI platform in China that provides many AI services from image recognition to semantic understanding, to do the sentiment analysis. According to its introduction, for Chinese texts with subjective descriptions, Baidu Brain automatically provides the sentiment polarity categorization (positive, negative and neutral) and the corresponding confidence levels based on deep learning training. We thus consider a posting positive (negative) if it is classified as positive (negative) by Baidu Brain and drop the positive postings. To alleviate the skewness of postings, we use the natural log of one plus the number of negative fundamental-related postings (*Posting*) to measure investors’ social media criticisms.

Perhaps, the most common measure for earnings management is the discretionary accruals. To calculate discretionary accruals, we use a modified version of the Jones model proposed by Dechow, Sloan, and Sweeney (1995), i.e. estimating discretionary accruals from cross-sectional regressions of total accruals on changes in sales and on property, plant, and equipment within industries.<sup>7</sup> Positive discretionary accruals are considered to be indicative of firms exercising income-increasing discretion, while negative discretionary accruals are thought to be indicative of income-decreasing discretion. As such, we follow prior literature (e.g. Yu 2008; Armstrong et al. 2013; Chen et al. 2021) and adopt the absolute value of discretionary accruals as the proxy for earnings management (*Disaccruals*).

Besides, to account for other factors’ effects that could both determine postings on stock message boards and earnings management, we control for a series of firm-level characteristics, similar to those in Yu (2008) and Jiang, Petroni, and Wang (2010b). Specifically, we include the market value (*Size*), the return on assets (*ROA*), the growth rate of assets (*Growth*), the book-to-market ratio (*BM*), the lagged cumulative one-year return (*Pastperform*), analyst coverage (*Analyst*), media coverage (*News*), the fraction of shares held by retail investors (*Retailholding*), the number of shareholders (*Shareholder*), the average holdings for each shareholder (*Averagehold*), the age (*Age*), the leverage (*Leverage*), the volatility of sales (*Salesvol*), the volatility of cash flow (*Cashvol*), and investor attention, which is measured with Baidu Search Volume Index (*Baidu*).<sup>8</sup>

We obtain data on the stock market, accounting, analyst coverage, and news reports from the CSMAR and WIND, two leading databases in China. And data on search frequency in Baidu are collected with a Web-scraping program. We delete special treatment (ST) stocks and firms listed on the SSE STAR market or in the financial industry from our sample.

### 3.2. Descriptive statistics

The descriptive statistics of our main variables are presented in Table 1. The mean (median) of the logarithm of negative fundamental-related postings on a given stock message board in a given year is 5.059 (4.966). As for the dependent variable, the average unsigned discretionary accruals is 7.093% of the total assets. Another notable finding of Table 1 is that some firm characteristics have extreme values. For example, the 95th percentile of ROA

**Table 1.** Descriptive statistics

	Mean	Std.	P5	P25	Median	P75	P95
<i>Posting</i>	5.059	0.968	3.579	4.444	4.966	5.611	6.808
<i> Disaccruals </i>	7.093	12.017	0.340	1.812	4.064	8.037	22.011
<i>Size</i>	22.525	0.949	21.195	21.855	22.413	23.064	24.221
<i>ROA</i>	0.041	0.190	-0.041	0.014	0.036	0.065	0.126
<i>Growth</i>	0.433	5.187	-0.131	0.013	0.096	0.229	0.851
<i>BM</i>	0.612	0.262	0.196	0.413	0.611	0.811	1.015
<i>Pastperform</i>	0.067	0.581	-0.490	-0.301	-0.092	0.269	1.113
<i>Analyst</i>	1.868	1.457	0.000	0.693	1.946	3.091	4.174
<i>News</i>	3.660	0.928	1.792	3.219	4.143	4.277	4.615
<i>Retailholding</i>	0.663	0.227	0.283	0.487	0.673	0.873	0.983
<i>Shareholder</i>	10.500	0.930	9.049	9.862	10.468	11.075	12.096
<i>Averagehold</i>	0.041	0.041	0.004	0.015	0.028	0.052	0.118
<i>Baidu</i>	11.982	1.106	10.486	11.301	12.009	12.648	13.730
<i>Age</i>	17.552	5.360	9.000	14.000	18.000	21.000	26.000
<i>Leverage</i>	1.480	13.228	0.122	0.388	0.789	1.530	4.048
<i>Cashvol</i>	0.133	0.696	0.015	0.032	0.053	0.093	0.290
<i>Salesvol</i>	0.683	5.708	0.030	0.086	0.163	0.327	1.470

Note: This table reports the descriptive statistics for firms in our sample. The sample consists of all non-financial firms that have stock message boards on guba.eastmoney.com from 2010 to 2019. All variables are defined in Appendix A.

is 0.126, while its median is only 0.036; the 95th percentile of the growth rate of assets is 0.851, while its median is only 0.096. To reduce the influence of outliers, we winsorize all variables at 1% and 99% levels.

### 3.3. Determinants of postings on Internet stock message boards

The number of negative fundamental-related posting on stock message boards is associated with many stock features, and some of these features may also determine earnings management. To control for these factors, we follow Yu (2008) and first estimate the following regression:

$$Posting_{i,t} = \alpha + \beta Determinants_{i,t} + \delta \sum Industry_i + \varphi \sum Year_t + \varepsilon_{i,t}, \quad (1)$$

where  $Posting_{i,t}$  is the natural logarithm of one plus the number of negative fundamental-related postings on the stock message board of stock  $i$  in year  $t$ ,  $Determinants_{i,t}$  is a vector of stock features that may influence both posting volume and earnings management, including *Size*, *ROA*, *Growth*, *BM*, *Pastperform*, *Analyst*, *News*, *Retailholding*, *Shareholder*, *Averagehold*, *Baidu*, *Age*, *Leverage*, *Cashvol*, and *Salesvol*. In addition, we also control for industry and year fixed effects in the regressions and cluster standard errors at the firm level.

According to results in Table 2, the negative fundamental-related postings on stock message boards are positively related to the growth rate of assets, the past market performance, the number of news reports, the ratio of shares held by retail investors, the number of shareholders, the average ratio of shares held by each shareholder, and search frequency in Baidu. The residual of the aforementioned regression can be viewed as a component of negative fundamental-related posting volume that is unrelated to the stock features listed above. Consequently, we employ this residual as a proxy for investors' social media criticisms on stock message boards and name it *Residualpost*.

### 3.4. Baseline regression results

To ascertain whether investors' social media criticisms constrain or promote earnings management, we regress the absolute value of *Disaccruals* on *Residualpost* and a series of control variables. Like the one in Yu (2008), the regression model takes the following form:

$$|Disaccruals_{i,t}| = \alpha + \beta Residualpost_{i,t} + \gamma Controls_{i,t} + \delta \sum Industry_i + \varphi \sum Year_t + \varepsilon_{i,t}, \quad (2)$$

**Table 2.** Determinants of postings on stock message boards

	Dependent variable: <i>Posting</i>
	(1)
<i>Size</i>	−0.022 (−1.533)
<i>ROA</i>	−0.046* (−1.710)
<i>Growth</i>	0.003** (2.053)
<i>BM</i>	−0.197*** (−5.277)
<i>Pastperform</i>	0.073*** (6.089)
<i>Analyst</i>	−0.018** (−2.174)
<i>News</i>	0.288*** (20.442)
<i>Shareholder</i>	0.533*** (22.976)
<i>Averagehold</i>	0.915** (2.531)
<i>Baidu</i>	0.103*** (11.068)
<i>Age</i>	−0.001 (−0.558)
<i>Leverage</i>	−0.016 (−0.846)
<i>Cashvol</i>	0.003 (0.733)
<i>Salesvol</i>	−0.001 (−0.926)
<i>Retailholding</i>	0.490*** (3.835)
<i>Intercept</i>	−0.491 (−1.211)
<i>Year FE</i>	Yes
<i>Industry FE</i>	Yes
<i>Observations.</i>	20,938
<i>AdjustedR<sup>2</sup></i>	69.52%

Note: This table shows the results of the ordinary least squares regression that investigates the determinants of postings on stock message boards and that generates the residual postings (*Residualpost*). The sample consists of all regular non-financial firms that have stock message boards on guba.eastmoney.com from 2010 to 2019. All variables are defined in Appendix A. T-statistics that are based on standard errors clustered by firms appear in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by \*, \*\*, and \*\*\*, respectively.

where  $Disaccruals_{i,t}$  is the discretionary accruals of firm  $i$  in year  $t$  that is calculated with the modified Jones model, and  $Residualpost_{i,t}$  is the residual obtained from estimating Eq. (1). Industry and year fixed effects are also included to control for macro-economic changes over time and account for unobserved heterogeneity across industries. To rule out the possibility that results could be driven by firm characteristics, we cluster standard errors by firms.

Columns (1) and (4) in Table 3 show the regression results obtained before and after controlling for a variety of firm features. Consistent with the *amplifying hypothesis*, the coefficients of *Residualpost* (i.e. 0.451 in column (1) and 0.430 in column (4)) are significantly positive, with a t-statistic larger than 5. In other words, all else equal, a one standard deviation increase in the investors' social media criticisms is associated with a 0.416 increase in discretionary accruals for a given firm. Considering that our proxy for postings on

**Table 3.** Postings on stock message boards and earnings management

	Dependent variable: $ Disaccruals $					
	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Residualpost</i>	0.451*** (5.465)	0.374*** (3.049)	0.568*** (4.942)	0.430*** (5.676)	0.366*** (3.039)	0.495*** (4.513)
<i>Size</i>				0.040 (0.327)	0.055 (0.692)	-0.018 (-0.319)
<i>ROA</i>				-1.503** (-2.434)	-1.154 (-1.477)	-2.241** (-1.989)
<i>Growth</i>				0.191*** (4.200)	0.189*** (2.593)	0.204*** (2.871)
<i>BM</i>				-3.117*** (-6.486)	-1.509** (-2.236)	-6.006*** (-9.352)
<i>Pastperform</i>				0.062 (0.241)	0.500* (1.820)	-0.292 (-1.037)
<i>Analyst</i>				-0.217*** (-4.326)	-0.056 (-0.684)	-0.381*** (-6.237)
<i>News</i>				1.238 (1.349)	0.985 (1.305)	1.497 (1.474)
<i>Shareholder</i>				-0.413*** (-2.846)	-0.367 (-1.471)	-0.400** (-2.362)
<i>Averagehold</i>				-8.164*** (-2.697)	-2.744 (-0.549)	-14.333*** (-4.406)
<i>Baidu</i>				-0.530*** (-5.947)	-0.537*** (-3.628)	-0.611*** (-4.773)
<i>Age</i>				0.016 (1.120)	0.014 (0.783)	0.014 (0.814)
<i>Leverage</i>				-0.231 (-0.695)	1.264*** (4.154)	-1.914** (-2.563)
<i>Cashvol</i>				0.823 (1.477)	1.040 (1.284)	0.741* (1.834)
<i>Salesvol</i>				-0.042 (-0.818)	-0.024 (-0.241)	-0.076 (-1.450)
<i>Retailholding</i>				2.511*** (8.057)	2.087*** (5.526)	2.442*** (6.471)
<i>Intercept</i>	7.947*** (9.077)	6.805*** (6.036)	8.536*** (7.180)	14.554*** (8.297)	12.402*** (5.015)	16.244*** (6.740)
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	20,938	10,708	10,230	20,938	10,708	10,230
<i>Adjusted R<sup>2</sup></i>	10.73%	13.51%	9.00%	16.53%	17.76%	15.21%

Note: This table presents the results of ordinary least squares regressions examining the effect of negative fundamental-related postings on stock message boards on earnings management. Columns (1) and (4) show the regression results of the whole sample. Columns (2) and (5) show the regression results of subsample with firms that have positive discretionary accruals while columns (3) and (6) show the regression results of subsample with firms that have negative discretionary accruals. All variables are defined in Appendix A. T-statistics that are based on standard errors clustered by firms appear in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by \*, \*\*, and \*\*\*, respectively.

stock message boards is free of the influence of various factors that could affect financial reporting quality (because it is a residual from regressions), in addition to statistical significance, this finding is of economic significance.

Digging deeper, we divide the whole sample into two groups based on whether the discretionary accruals are positive or negative and then estimate Eq. (2) in these two groups, respectively. From the rest of the columns in Table 3, we can see that the coefficients of *Residualpost* continue to be positive regardless of the sign of discretionary accruals. This means that managers' exercising of income-decreasing discretion and exercising of income-increasing discretion are both amplified by negative fundamental-related postings on stock message boards.

### 3.5. Identification attempts

A serious concern with the OLS test is the endogeneity problem. Specifically, it is possible that firms who manipulate earnings receive more investors' social media criticisms. Meanwhile, some unobservable factors could drive both posting activities and earnings management. To address the omitted variable and reverse causality concerns, we employ two identification strategies.

#### 3.5.1. Instrumental variable approach

The first identification strategy is based on the instrumental variable approach. We employ the number of times a stock hits price limits as an instrumental variable to capture the variation in social media criticisms that is exogenous to earnings management. The Chinese stock market imposes daily price limits of 10% on regular stocks. According to Seasholes and Wu (2007) and Chen et al. (2019), stocks that hit price limits (i.e. price limit events) usually attract great investor attention because trading software and media reports always display the list of such stocks on a daily basis. Intuitively, attention-grabbing stocks are more likely to be heated discussed by individual investors and receive more social media criticisms. Thus, the number of negative fundamental-related postings should be positively correlated with the number of price limit events for a given stock.

A potential concern with using price-related measures as the instrumental variable is that stock prices could affect managers' incentives for earnings management. This is because managers' total compensation is often tied to the value of stock and option holdings (Cheng and Warfield 2005; Bergstresser and Philippon 2006). Consequently, when the stock price is worse than expected, managers are more likely to manipulate earnings. However, the number of price limit events is not necessarily related to particularly good or bad stock price performance. As shown by Seasholes and Wu (2007) and Chen et al. (2019), hitting price limits often coincides with significant price reversal in the subsequent weeks. To sum, the number of price limit events (*Hitevents*) satisfies the exclusion restriction.

We estimate the two-stage least squares (2SLS) regressions as follows:

$$Residualpost_{i,t} = \alpha_1 + \beta_1 Hitevents_{i,t} + \gamma_1 Controls_{i,t} + \delta_1 \sum Industry_i + \varphi_1 \sum Year_t + \epsilon_{i,t}, \quad (3)$$

$$|Disaccrual_{i,t}| = \alpha_2 + \beta_2 Residualpost_{i,t} + \gamma_2 Controls_{i,t} + \delta_2 \sum Industry_i + \varphi_2 \sum Year_t + \epsilon_{i,t},$$

where  $Hitevents_{i,t}$  is the number of times stock  $i$  hit daily price limits in year  $t$ . The definitions of other variables are the same as those in Eq. (2).  $Industry_i$  and  $Year_t$  denote industry and firm fixed effects, respectively. And the standard errors are clustered at the firm level.

To examine the relevance of *Hitevents*, we present the first-stage regression with *Residualpost* as the dependent variable and *Hitevents* as the main independent variable in the first column of Table 4.<sup>9</sup> The coefficient of *Hitevents* is positive and has a large t-statistic, indicating that *Hitevents* is positively related to *Residualpost*. Meanwhile, the  $p$ -value of the F-test at the bottom of this table is close to zero, which suggests that *Hitevents* is highly correlated with *Residualpost*. According to the rule of thumb with one instrumental variable for one endogenous variable, we could reject that the instrumental variable is weak. The results of the second-stage regression are reported in the rest columns of Table 4. As expected, the coefficients of *Residualpost* are positive and significant at the 1% level, no matter in the whole sample or the subsample with positive (negative) discretionary accruals. The 2SLS result establishes that investors' social media criticisms appear to amplify firms' earnings management, providing further support to the *amplifying hypothesis*.<sup>10</sup>

#### 3.5.2. Difference-in-differences approach

In addition to the instrumental variable approach, we employ another identification strategy, i.e. the difference-in-differences (DiD) approach based on the launch of the mobile App for Guba EastMoney in November 2012 (Jiang, Liu, and Yang 2019).

The launch of the mobile App for the Guba EastMoney is a good candidate for a quasi-natural experiment for several reasons. First, the number of postings (including the negative postings we focus on in this paper) on Internet stock message boards greatly rises after the launch of the mobile App for the Guba EastMoney (Jiang,

**Table 4.** Instrumental variable approach

	Dependent variable: <i>Residualpost</i>		Dependent variable: $ Disaccruals $		
	First Stage	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0	
	(1)	(2)	(3)	(4)	
<i>Hitevents</i>	0.047*** (27.072)				
<i>Residualpost</i>		0.420*** (4.186)	0.424*** (3.535)	0.336** (2.329)	
<i>Controls</i>	Yes	Yes	Yes	Yes	
<i>Year FE</i>	Yes	Yes	Yes	Yes	
<i>Industry FE</i>	Yes	Yes	Yes	Yes	
<i>F-test</i>	6.153				
<i>P-value</i>	< 0.000				
<i>Observations</i>	20,938	20,938	10,708	10,230	
<i>Adjusted R<sup>2</sup></i>	3.99%	17.05%	18.70%	15.52%	

Note: This table presents the results of the 2-stage least squares (2SLS) regressions examining the effect of postings on stock message boards on earnings management. The instrumental variable for negative fundamental-related postings on stock message boards (*Residualpost*) is the number of price limit events for a stock in a year. Columns (1) in both panels show the results of the first-stage regression. Columns (2) to (4) in both panels show the second-stage regression results of the whole sample, the subsample with firms that have positive discretionary accruals, and the subsample with firms that have negative discretionary accruals. All variables are defined in Appendix A. T-statistics that are based on standard errors clustered by firms appear in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by \*, \*\*, and \*\*\*, respectively.

Liu, and Yang 2019) for the convenience of using mobile phones. And there is variation in the increase of posting volume in the cross-section of stocks. Second, the launch of the mobile App is primarily due to the development of technology and the popularity of mobile phones. Hence, it is unlikely that the launch of the mobile App directly influences firms' earnings management. That is to say, the launch of the mobile App for the Guba EastMoney can generate exogenous variation in posting volume.

We construct a treatment group and a control group using propensity score matching. Specifically, we first measure the change in social media criticisms before and after the launch of the mobile App by subtracting the number of negative fundamental-related postings in 2012 from that in 2013 for each firm in our sample. We then sort all these firms into terciles and retain only the top tercile, i.e. firms that experience the largest increase in the number of negative fundamental-related postings surrounding the launch of the mobile App. After that, we employ a propensity score matching algorithm to identify matches between firms in the top tercile and firms in the bottom tercile.

When applying the propensity score matching, we estimate a probit model for observations in 2012, the independent variables of which is the same as the control variables in Eq. (2). Besides, we also include earnings management growth, i.e. the growth in the absolute value of discretionary accruals (*Growthaccruals*) computed over two years before the launch of the mobile App, as well as firm and year fixed effects in the regression. The dependent variable equals one if the firm-year observation belongs to the top tercile and zero if it belongs to the bottom tercile. We then use the predicted probabilities from the probit regression to perform the nearest-neighbor propensity score matching. In particular, each firm in the top tercile (i.e. treatment group) is matched to a firm from the bottom tercile with the closest propensity score (i.e. control group). After conducting the propensity score matching, we end up with 278 unique treatment firms and 278 unique control firms. The validity of the DiD estimates primarily depends on the parallel-trend assumption. To ensure that our DiD sample satisfies the parallel-trend assumption, we perform two diagnostic tests.<sup>11</sup>

After that, we undertake the univariate DiD test. To do so, we compute DiD estimators for discretionary accruals by first subtracting the average unsigned discretionary accruals over the two years before the launch of the mobile App from the average unsigned discretionary accruals over the two years after the launch of the mobile App for each firm in treatment and control groups. The difference between these two periods is then averaged over the two groups and is presented in the first two columns in Panel A of Table 5. We observe no

**Table 5.** Difference-in-differences analysis

Panel A Univariate DiD estimators			
	Treatment (After-Before)	Control (After-Before)	Treatment-Control (DiD Estimator)
	(1)	(2)	(3)
Disaccruals	4.545*** (2.769)	0.251 (0.499)	4.294** (2.354)
Panel B Multivariate DiD regression			
	Dependent variable:  Disaccruals		
	(1)	(2)	
Treat*Post	3.921** (2.037)	3.473** (2.233)	
Controls	No	Yes	
Year FE	Yes	Yes	
Firm FE	Yes	Yes	
Observations	2,503	2,503	
Adjusted R <sup>2</sup>	19.20%	19.37%	

Note: This table reports the results of the difference-in-differences (DiD) tests on how a plausibly exogenous shock to the number of negative fundamental-related posting on stock message boards, which is due to the launch of mobile App for Guba East-money, affects earnings management. Firms are sorted into terciles based on their change in social media criticisms from the year before the launch of mobile App to the year after the launch of the mobile App. The top tercile is the treatment group and the bottom tercile constitute the control group. We match firms using one-to-one nearest neighbor propensity score matching without replacement. Panel A reports the univariate DiD estimators, with t-statistics displayed in parentheses. Panel B reports the multivariate DiD test results. All variables are defined in Appendix A. t-statistics that are based on standard errors clustered by firms appear in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by \*, \*\*, and \*\*\*, respectively.

significant difference in the discretionary accruals before and after the launch of the mobile App for firms in the control group. In sharp contrast, there is an obvious increase (with a t-statistic of 2.769) in the discretionary accruals for firms in the treatment group around the launch of the mobile App. Likewise, the DiD estimate reported in column (3) is positive at the 5% significance level.

Next, we conduct the DiD tests by running the following regression model:

$$|Disaccruals_{i,t}| = \alpha + \beta Treat_{i,t} * Post_{i,t} + \gamma Controls_{i,t} + \delta \sum Firm_i + \varphi \sum Year_t + \varepsilon_{i,t}, \quad (4)$$

where  $Disaccruals_{i,t}$  is the discretionary accruals of firm  $i$  in year  $t$  estimated from the modified Jones model.  $Treat_{i,t}$  is a dummy variable that takes the value of one for firms in the treatment group and zero for firms in the control group.  $Post_{i,t}$  is also a dummy variable that takes the value of one if the year is after 2013, and zero otherwise. The coefficient of the interaction term  $Treat_{i,t} \times Post_{i,t}$  is the DiD estimator that captures the causal effect of postings on stock message boards on earnings management.  $Controls_{i,t}$  is a vector of control variables, same as those in Eq. (2).  $Firm_i$  and  $Year_t$  represent firm and year fixed effects. The standard errors are clustered at the firm level.

Panel B in Table 5 paints a picture similar to those painted by the previous tables. Specifically, the coefficient of  $Treat \times Post$  is 3.921, significant at the 5% level, with no other control variables but the industry and firm fixed effects. And this coefficient drops a bit to 3.473, with a t-statistic of 2.233, when controlling for other firm characteristics. These results again reinforce the *amplifying hypothesis*, i.e. social media criticisms on stock message boards promote earnings management.

### 3.5.3. The effect of change of social media criticisms

Another strategy to deal with the endogeneity issue is to examine the effect of the change in social media criticisms on the change in the level of discretionary accruals in the subsequent year.

$$\Delta |Disaccrual_{i,t}| = \alpha + \beta \Delta Residualpost_{i,t-1} + \gamma Controls_{i,t} + \delta \sum Industry_i + \varphi \sum Year_t + \varepsilon_{i,t}, \quad (5)$$



**Table 6.** Changes in discretionary accruals and social media criticisms

	$\Delta Disaccruals _t$	$\Delta Residualpost_t$
$\Delta Residualpost_{t-1}$	0.261*** (2.795)	
$\Delta Disaccruals _{t-1}$		0.001 (1.536)
Controls	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	15,861	15,861
Adjusted R <sup>2</sup>	4.35%	0.53%

Note: This table reports the results of ordinary least squares regressions examining the relation between the change in social media criticisms and the change in discretionary accruals. All variables are defined in Appendix A. T-statistics that are based on standard errors clustered by firms appear in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by \*, \*\*, and \*\*\*, respectively.

where  $\Delta|Disaccruals_{i,t}|$  is the change in discretionary accruals of firm  $i$  from year  $t-1$  to year  $t$ , and  $\Delta Residualpost_{i,t}$  is the change in social media criticisms firm  $i$  from year  $t-2$  to year  $t-1$ . Standard errors are clustered at the firm level.

The results are shown in Table 6. The coefficient of  $\Delta Residualpost$  in column (1) is 0.261, significant at the 1% level, suggesting that the change in social media criticisms positively predicts the change in discretionary accruals in the future.

In a like manner, we also check how the change in earnings management is related to the subsequent change in social media criticisms by using  $\Delta Residualpost$  in year  $t$  as the dependent variable and  $\Delta|Disaccruals|$  in year  $t-1$  as the main independent variable. From column (2) in Table 6, we can see that the coefficient of  $\Delta|Disaccruals|$  is insignificant. The results further confirm that it is the change in social media criticisms that leads to the change in discretionary accruals, rather than vice versa.

### 3.6. Robustness checks

To ensure the robustness of our findings, we conduct a battery of tests. The first group of tests is associated with how we measure earnings management. In the above analysis, we estimate discretionary accruals from the modified Jones model (Dechow, Sloan, and Sweeney 1995). Following Armstrong et al. (2013), we also calculate discretionary accruals from models proposed by Dechow and Dichev (2002) (*DDiscre*) and McNichols (2002) (*MDiscre*). Our main results are not changed in any material way in the first two columns of Panel A in Table 7. Specifically, we continue to observe a positive relation between negative fundamental-related postings and earnings management.

According to Chen et al. (2021), managers manipulate earnings via two main channels: accrual-based and real earnings management. While accrual-based earnings management is usually conducted by modifying the accounting methods or estimates used when displaying a transaction in the financial statements (Zang 2012), real earnings management refers to the usage of real activities to manipulate earnings (Cohen and Zarowin 2010). Therefore, we also identify the impact of negative fundamental-related postings on firms' earnings management in terms of real earnings management. Following Cohen and Zarowin (2010), we exploit two comprehensive real earnings management measures: REM1 and REM2. The former is defined as the abnormal production costs minus the abnormal discretionary expenses, and the latter is the sum of minus abnormal operating cash flows and minus abnormal discretionary expenses.<sup>12</sup> As shown in columns (3) and (4) of Panel A in Table 7, the coefficients of *Residualpost* remain to be positive at the 1% significance level, implying that social media criticisms also encourage managers' real earnings management.

Another concern with our results could be our measurement for social media criticisms. Hence, the second group of tests replicates the baseline analysis with alternative social media criticism measures. First, we use the original value of negative fundamental-related postings on stock message boards, i.e. *Posting*, rather than the

residual from estimating Eq. (1), as the main independent variable. The second measure is the relative number of negative fundamental-related postings, i.e. the ratio of the number of negative fundamental-related postings to the total number of fundamental-related postings (*Ratio*). The results obtained from using these two measures are reported in Panel B in Table 7. Again, none of these checks meaningfully alters our main results. We observe significantly positive coefficients of social media criticism measures in all cases.

In addition, Chen, Hribar, and Melessa (2018) and Christodoulou, Ma, and Vasnev (2018) argue that the usage of residuals as the dependent variable could generate biased coefficients and standard errors. To mitigate this issue, we employ two approaches. In the first test, we estimate the coefficients for all independent variables in both the regression to obtain discretionary accruals and Eq. (2) in a single regression. The results are presented in column (1) of Panel C in Table 7. The coefficient of interest remains significantly positive. Column (2) reports results from another approach, i.e. we regress the discretionary accruals on the combination of all independent variables in Eq. (2) and the regression to calculate discretionary accruals. Again, the coefficient of interest in this case is positive at the 5% significance level.

We also check whether there is any significant change in our main conclusion after incorporating the natural logarithm of one plus the total number of postings (*Totalpost*) as an additional control variable. The coefficients of *Residualpost* reported in Panel D of Table 7 remain significantly positive.

**Table 7.** Robustness checks

Panel A Alternative discretionary accruals measures				
	Accrual-based earnings management		Real earnings management	
	DDiscre	MDiscre	REM1	REM2
	(1)	(2)	(3)	(4)
<i>Residualpost</i>	0.498*** (7.445)	0.406*** (6.674)	1.176*** (2.655)	0.545** (2.557)
<i>Controls</i>	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes
<i>Observations</i>	20,938	20,938	20,938	20,938
<i>Adjusted R<sup>2</sup></i>	11.89%	10.83%	7.14%	7.88%
Panel B Alternative social media criticism measures				
	Dependent variable:  Disaccruals			
	(1)	(2)		
<i>Posting</i>	0.400*** (5.740)			
<i>Ratio</i>		2.899*** (4.596)		
<i>Controls</i>	Yes	Yes		
<i>Year FE</i>	Yes	Yes		
<i>Industry FE</i>	Yes	Yes		
<i>Observations</i>	20,938	20,938		
<i>Adjusted R<sup>2</sup></i>	17.02%	14.97%		
Panel C Issues with using residuals as the dependent variable				
	Dependent variable: TA	Dependent variable:  Disaccruals		
	(1)	(2)		
<i>Residualpost</i>	0.182** (2.272)	0.173** (2.048)		
<i>Controls</i>	Yes	Yes		
<i>Year FE</i>	Yes	Yes		
<i>Industry FE</i>	Yes	Yes		
<i>Observations</i>	20,938	20,938		
<i>Adjusted R<sup>2</sup></i>	85.58%	85.10%		

(continued)

**Table 7.** Continued.

Panel D Controlling for the total number of postings			
	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0
	(1)	(2)	(3)
<i>Residualpost</i>	0.308*** (3.665)	0.336*** (3.399)	0.242** (2.043)
<i>Totalpost</i>	0.239** (2.510)	0.151* (1.805)	0.749*** (5.296)
<i>Controls</i>	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes
<i>Observations</i>	20,938	10,708	10,230
<i>Adjusted R<sup>2</sup></i>	16.06%	17.26%	15.13%

Note: This table shows the results of robustness checks. Panel A presents whether the positive relation between social media criticisms and earnings management depends on earnings management measurement. Column (1) reports the regression results by calculating discretionary accruals with the model proposed by Dechow and Dichev (2002). Column (2) reports the results by calculating discretionary accruals with the model proposed by McNichols (2002). Column (3) reports the regression results by adopting REM1 as a measure of real earnings management. And column (4) reports the regression results by adopting REM2 as a measure of real earnings management. Panel B presents whether the positive relation between social media criticisms and earnings management depends on social media criticism measurement. Column (1) reports the regression results by using *Posting* as the main independent variable. And column (2) reports the regression results by using *Ratio* as the main independent variable. Panel C presents whether the methods proposed by Chen, Hribar, and Melessa (2018) to correct the biased inference resulted from using the residual as the dependent variable could affect the main conclusion. Column (1) reports the results by estimating the coefficients for all the model regressors in a single-step regression. And column (2) shows the results by regressing the residual from a first-step regression on the combination of all the second-step regressors and all the first-step regressors. Panel D reports the regression results by incorporating *Totalpost* as an additional control variables. Column (1) shows the regression results of the whole sample. Column (2) shows the regression results of subsample with firms that have positive discretionary accruals while column (3) shows the regression results of subsample with firms that have negative discretionary accruals. All variables are defined in Appendix A. T-statistics that are based on standard errors clustered by firms appear in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by \*, \*\*, and \*\*\*, respectively.

Collectively, these results suggest that the positive relation between social media criticisms and earnings management could not simply be a statistic artifact or a measurement error.

### 3.7. Heterogeneity by user levels

So far, we have demonstrated that postings on Internet stock message boards can promote earnings management. In the following test, we continue to explore whether posting-level characteristics might influence the relation between postings and earnings management.

The Guba EastMoney grants users different levels based on how long the user has been registered and how many comments, reposts as well as likes the user has received. As user level can be perceived as a measure of a user's influence, negative messages posted by different levels of users may affect firms' earnings management differently. There are ten levels for users on Guba EastMoney, with one being the lowest level and ten being the highest level. Hence, we count the number of negative fundamental-related messages posted by users with levels from one to five (i.e. junior users) and label it *Juniorpost*. Likewise, we count the number of negative fundamental-related messages posted by users with levels from six to ten (i.e. senior users) and label it *Seniorpost* separately. And regressions in Table 2 are then repeated, with *Seniorpost* and *Juniorpost* being the dependent variable. After that, we employ the residuals from these regressions to replace *Residualpost* as the key independent variable and present the results in Table 8. As expected, regardless of the sign of discretionary accruals, the coefficients of *Residualpost* are larger for senior users than those for junior users, and the differences are statistically significant. Put differently, senior users' criticisms exert more pressure on managers to manage earnings.

### 3.8. Positive postings

In addition to social media criticisms, we also explore whether investors' praises for firms affect managers' opportunistic earnings manipulation behaviors.<sup>13</sup> For this purpose, we calculate the number of positive

**Table 8.** Heterogeneity analysis

	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Senior users</b>						
<i>Residualpost</i>	0.452*** (3.885)	0.295** (2.344)	0.689*** (5.207)	0.478*** (5.544)	0.318*** (2.645)	0.679*** (4.814)
<i>Controls</i>	No	No	No	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	20,938	10708	10230	20,938	10708	10230
<i>Adjusted R<sup>2</sup></i>	10.65%	14.08%	9.80%	16.43%	17.93%	15.67%
<b>Junior users</b>						
<i>Residualpost</i>	0.333*** (2.779)	0.242* (1.787)	0.501*** (2.938)	0.399*** (3.939)	0.271** (2.049)	0.546*** (2.829)
<i>Controls</i>	No	No	No	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	20,938	10708	10230	20,938	10708	10230
<i>Adjusted R<sup>2</sup></i>	10.52%	13.05%	9.29%	16.52%	17.27%	15.59%
<i>Coef. dif.</i>	0.119*	0.053**	0.188*	0.079**	0.047*	0.133**

Note: This table shows how different user levels impact the relation between postings on stock message boards and earnings management. The first half of the table presents the results with the residual of messages posted by senior users, and the rest of the table shows the results with the residual of messages posted by junior users. The last row reports whether the differences between coefficients of interest in the first half and the rest of the table are statistically significant. Columns (1) and (4) show the regression results of the whole sample. Columns (2) and (5) show the regression results of subsample with firms that have positive discretionary accruals while columns (3) and (6) show the regression results of subsample with firms that have negative discretionary accruals. All variables are defined in Appendix A. T-statistics that are based on standard errors clustered by firms appear in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by \*, \*\*, and \*\*\*, respectively.

**Table 9.** Positive postings

	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0
	(1)	(2)	(3)
<i>Residualppost</i>	0.306*** (2.967)	0.230** (2.094)	0.346** (2.546)
<i>Controls</i>	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes
<i>Observations</i>	20,938	10,708	10,230
<i>Adjusted R<sup>2</sup></i>	16.24%	17.13%	15.34%

Note: This table presents the results of ordinary least squares regressions examining the effect of positive fundamental-related postings on stock message boards on earnings management. Column (1) shows the regression results of the whole sample. Column (2) shows the regression results of subsample with firms that have positive discretionary accruals while column (3) shows the regression results of subsample with firms that have negative discretionary accruals. All variables are defined in Appendix A. T-statistics that are based on standard errors clustered by firms appear in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by \*, \*\*, and \*\*\*, respectively.

fundamental-related postings on stock message boards with the same approach introduced in subsection 3.1. After that, we obtain the residuals from estimating Eq. (1) but replace *Posting* with the number of positive fundamental-related postings and name it *Residualppost*. And then, Eq. (2) is re-estimated with *Residualppost* being the main independent variable in the whole sample and samples with either positive or negative discretionary accruals groups. The results are presented in Table 9. We continue to observe a positive relation between the number of positive fundamental-related postings and earnings management as the coefficients of *Residualppost* are all significantly positive in three columns of Table 9.

## 4. Potential explanations of the relation

Even if the aforementioned tests demonstrate that negative fundamental-related postings on stock message boards cause serious earnings management, this finding does not necessarily point to the cognitive evaluation theory. In this section, we attempt to provide supporting evidence to the cognitive evaluation theory and rule out alternative explanations.

### 4.1. Cognitive evaluation theory

Cognitive evaluation theory claims that external mechanisms of control can impinge on managers' sense of autonomy, thereby reducing their motivation to behave in ways that are consistent with their responsibilities to firms. Although the core idea of this theory is quite straightforward, it is not easy to test this theory directly because of the difficulties in measuring managers' feelings. A natural compromise is to estimate the constraints and incentives of managers who plan to inflate or deflate earnings. The rationale behind this design is that managers should be more inclined to manipulate earnings under social media criticisms' pressure if they face looser restrictions and stronger motivations.

#### 4.1.1. Incentives

According to Wang and Yung (2011), managers of state-owned enterprises face less pressure than their counterparts in privately-owned businesses to manage corporate earnings because the debt covenant constraints are minimal, and the option-based compensation is uncommon for them. Therefore, we use the ownership structure of a firm as a proxy for the manager's earnings management incentive and repeat our baseline analysis among state-owned enterprises and privately-owned companies. If the cognitive evaluation theory can explain the social media criticisms' impact on earnings management, we should observe that the positive relation between negative fundamental-related postings and earnings management is more obvious in privately-owned enterprises. This is what exactly is portrayed in Panel A of Table 10. The coefficients of *Residualpost* are almost all insignificant for state-owned enterprises except those in the full sample cases. In sharp contrast, for non-state-owned enterprises, the coefficients of *Residualpost* are almost all significant at the 1% level. And the differences between these coefficients of interest are also statistically significant. These findings lend support to the cognitive evaluation theory.

Another factor influencing managers' incentive to manipulate earnings is industry competition because the boost in the market value of reporting good earnings is more important in more competitive markets (Markarian and Santalo 2014). That is to say, the magnitude of market competition could be utilized to measure earnings management incentives. Following Markarian and Santalo (2014), we use the Herfindahl-Hirschman industrial concentration index (HHI) to estimate the industrial competition and then divide the sample into two groups based on the value of HHI. The baseline regression is rerun among firms in the competitive environment and those in the uncompetitive environment. Overall results in Panel B of Table 10 are consistent with the prediction of cognitive evaluation theory, i.e. when managers face fiercer industrial competition, they are more likely to be encouraged by negative fundamental-related postings on stock message boards to engage in earnings management. The differences between coefficients of interest in the competitive environment and in the uncompetitive environment are significant at the 1% or 5% level.

In sum, results in the first two panels of Table 10 offer the first piece of evidence on the cognitive evaluation theory.

#### 4.1.2. Restrictions

External monitoring can impose restrictions on managers' earnings manipulation. Several studies demonstrate that institutional investors, analyst coverage, and news reports can also deter firms' involvement in financial misconduct (Yu 2008; Dyck, Morse, and Zingales 2010; Chen et al. 2016, 2021). Hence, we employ three variables, namely *Analyst*, *News*, and *Retailholding*,<sup>14</sup> to measure the external governance of a given firm. To mitigate potential measurement errors and the correlations among these three variables, we create a composite external governance index (motivated by the way of creating a firm-level transparency index from Zhong (2018)) on

**Table 10.** Cognitive evaluation theory

Panel A State ownership						
	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0
	(1)	(2)	(3)	(4)	(5)	(6)
<b>State-owned enterprises</b>						
<i>Residualpost</i>	0.410*	0.315	0.658*	0.418*	0.322	0.626
	(1.784)	(1.270)	(1.776)	(1.801)	(0.878)	(1.274)
<i>Controls</i>	No	No	No	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	4,148	2,116	2,032	4,148	2,116	2,032
<i>Adjusted R<sup>2</sup></i>	14.32%	17.72%	13.04%	20.34%	25.49%	21.48%
<b>Non-state-owned enterprises</b>						
<i>Residualpost</i>	0.555***	0.361**	0.878***	0.606***	0.428***	0.903***
	(3.873)	(2.126)	(4.672)	(4.545)	(3.024)	(6.060)
<i>Controls</i>	No	No	No	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	16,790	8,592	8,198	16,790	8,592	8,198
<i>Adjusted R<sup>2</sup></i>	9.97%	12.52%	10.12%	16.37%	18.57%	14.75%
<i>Coef. dif.</i>	0.145**	0.046***	0.220***	0.188***	0.106***	0.277***
<b>Panel B Industry competition</b>						
	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Competitive environment</b>						
<i>Residualpost</i>	0.666***	0.453**	0.786***	0.614***	0.403***	0.809***
	(3.986)	(2.509)	(2.816)	(3.255)	(3.039)	(3.678)
<i>Controls</i>	No	No	No	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	11,017	5,604	5,412	11,017	5,604	5,412
<i>Adjusted R<sup>2</sup></i>	10.14%	11.41%	12.24%	17.91%	17.37%	15.96%
<b>Noncompetitive environment</b>						
<i>Residualpost</i>	0.470**	0.158	0.520**	0.227**	0.207	0.654**
	(2.196)	(0.660)	(1.995)	(2.005)	(1.099)	(2.419)
<i>Controls</i>	No	No	No	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	9,921	5,104	4,818	9,921	5,104	4,818
<i>Adjusted R<sup>2</sup></i>	13.48%	17.08%	7.62%	17.00%	26.89%	18.61%
<i>Coef. dif.</i>	0.196**	0.295***	0.266**	0.387***	0.196***	0.155***
<b>Panel C External governance</b>						
	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Good external governance</b>						
<i>Residualpost</i>	0.470**	0.406	0.560**	0.372**	0.351	0.582**
	(2.176)	(1.526)	(2.386)	(2.106)	(1.625)	(2.235)
<i>Controls</i>	No	No	No	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	12,586	6,484	6,102	12,586	6,484	6,102
<i>Adjusted R<sup>2</sup></i>	14.79%	17.70%	11.01%	18.59%	21.75%	15.82%

(continued)

**Table 10.** Continued.

Panel C External governance						
	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Bad external governance</b>						
<i>Residualpost</i>	0.775*** (5.519)	0.505** (2.404)	1.135*** (5.162)	0.687*** (4.300)	0.436** (2.239)	0.989*** (3.662)
<i>Controls</i>	No	No	No	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	8,352	4,224	4,128	8,352	4,224	4,128
<i>Adjusted R<sup>2</sup></i>	7.92%	6.64%	11.84%	14.27%	14.32%	17.83%
<i>Coef. dif.</i>	0.305***	0.099***	0.575***	0.315**	0.085***	0.407***
<b>Panel D Religion</b>						
	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0	All firms	<i>Disaccruals</i> > 0	<i>Disaccruals</i> < 0
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Great religious influence</b>						
<i>Residualpost</i>	0.444** (2.418)	0.215 (0.865)	0.660** (2.504)	0.527*** (2.847)	0.273 (1.285)	0.730** (2.387)
<i>Controls</i>	No	No	No	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	9,724	4,916	4,808	9,724	4,916	4,808
<i>Adjusted R<sup>2</sup></i>	10.98%	14.60%	10.41%	18.07%	19.29%	20.30%
<b>Small religious influence</b>						
<i>Residualpost</i>	0.637*** (3.777)	0.480** (2.386)	0.872*** (4.247)	0.692*** (4.542)	0.556*** (2.708)	0.894*** (4.375)
<i>Controls</i>	No	No	No	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	11,131	5,745	5,386	11,131	5,745	5,386
<i>Adjusted R<sup>2</sup></i>	11.51%	14.26%	8.63%	17.24%	20.55%	14.78%
<i>Coef. dif.</i>	0.193**	0.265***	0.212**	0.265**	0.283***	0.164***

Note: This table shows whether the cognitive evaluation theory can explain the positive relation between postings on stock message boards and earnings management. Panel A presents the impact of state ownership on the relation between social media criticisms and earnings management. Panel B presents the impact of industry competition on the relation between social media criticisms and earnings management. Panel C presents the impact of external governance on the relation between social media criticisms and earnings management. Panel D presents the impact of religion on the relation between social media criticisms and earnings management. In each panel, we sort firms into two groups based on a firm characteristic and run regressions in Table 3 in these two groups, respectively. The first half presents the results within a group, the rest shows the results within the other group, and the last row reports whether the differences between coefficients of interest in the first half and the rest are statistically significant. Columns (1) and (4) show the regression results of the whole sample. Columns (2) and (5) show the regression results of subsample with firms that have positive discretionary accruals, while columns (3) and (6) show the regression results of subsample with firms that have negative discretionary accruals. All variables are defined in Appendix A. T-statistics that are based on standard errors clustered by firms appear in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by \*, \*\*, and \*\*\*, respectively.

the average of the scaled percentile rank of the above three components, with higher values indicating better external governance. Intuitively, firms that are monitored effectively by outsiders are less likely to be propelled by social media criticisms to manage earnings.

In a like manner, we sort firms into two groups based on the average value of this external governance index over the sample period. Regressions in Table 3 are repeated in the group with good external governance and the group with bad external governance. It is clear from Panel C of Table 10 that negative fundamental-related postings are more tightly correlated with earnings management among firms with low scores in terms of the external governance index. We also test the differences between coefficients of interest in these two groups and find that they are statistically significant.



In addition to formal monitoring mechanisms, some informal monitoring forces, such as social norms (Parsons, Sulaeman, and Titman 2018) and religion (Du et al. 2015), also play a critical role in curbing the opportunistic behaviors of managers. Following this strand of literature, we use the location information of firms, Buddhist monasteries, and Taoist temples provided by the CSMAR database. Based on the number of Buddhist monasteries and Taoist temples that are located within a 200 kilometers radius around firm headquarters, we separate firms into those exposed to religion and those that are not. We then conduct the baseline regression analysis in these groups and report results in Panel D of Table 10. We can see that firms that are less prone to be affected by religion are also more likely to manage earnings under the pressure of social media criticisms since the coefficients of interest among firms exposed to religion are significantly higher than those among other firms. All the above findings accord well with the prediction of the cognitive evaluation theory, i.e. the less severe constraints managers face, the more significant the relation between social media criticisms and earnings management.<sup>15</sup>

## 4.2. Potential alternative explanations

Although we have verified that the cognitive evaluation theory can account for the positive impact of stock message boards on earnings management, there is a likelihood that other nonexclusive hypotheses, i.e. deterioration in internal governance and operating performance, can jointly explain the positive link between negative fundamental-related postings and earnings management.

### 4.2.1. Internal governance

It is widely accepted that effective internal governance can deter earnings management (Klein 2002; Liu and Lu 2007). Given that Internet stock message boards can be used as a platform to bring corporate fraud to light, there is a possibility that a large number of social media criticisms simply signal deterioration in firms' internal governance.

To rule out this explanation, we regress a series of measures of internal governance proposed by Liu and Lu (2007) on *Residualpost* and other firm features. These measures include the ownership of non-controlling blockholders (*Outblock*), the percentage of shares held by the largest shareholder (*Topshare*), and the ratio of directors not receiving any compensation from the company (*Indirector*). Apart from control variables incorporated in Eq. (2), we also include the industry and year fixed effects and cluster standard errors at the firm level in the regressions.

According to Liu and Lu (2007), *Outblock* and *Indirector* are positively associated with the internal governance of a given firm, while *Topshare* is negatively correlated with the internal governance of a given firm. Hence, if more negative fundamental-related postings point to the deterioration of internal governance, we anticipate a significantly negative relation between the number of negative fundamental-related postings and *Outblock* or *Indirector* but a significantly positive relation between the number of negative fundamental-related postings and *Topshare*. This is apparently not the case with Panel A of Table 11. Instead, the coefficients of *Residualpost* are positive at the 1% significance level when *Outblock* or *Indirector* serves as the dependent variable, and the coefficients are negative at the conventional levels when *Topshare* serves as the dependent variable. These findings imply that social media criticisms enhance the internal governance of firms instead. Based on this evidence, we can safely rule out the internal governance explanation.

### 4.2.2. Operating performance

Another plausible reason for the positive relation between negative fundamental-related postings and earnings management is the decline in operating performance. According to the model created by Maksimovic and Titman (1991), poorly performing firms have less to lose from the risk of getting caught. Consequently, their incentive to engage in misconduct is higher than other firms with the promising future.

To minimize the possibility, we conduct a regression analysis similar to those in Panel A of Table 11 but using three variables, i.e. sales growth (*Salesgrowth*), capital expenditure growth (*Capitalgrowth*), and operating income growth (*Incomegrowth*) as the dependent variables, which are proposed by Hsu, Reed, and Rocholl

**Table 11.** Potential explanations

Panel A Internal governance						
	Dependent variable: <i>Outblock</i>		Dependent variable: <i>Topshare</i>		Dependent variable: <i>Indirector</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Residualpost</i>	0.695*** (3.690)	0.799*** (3.885)	−0.365* (−1.724)	−0.354** (−2.136)	0.916*** (3.870)	0.848*** (3.759)
<i>Controls</i>	No	Yes	No	Yes	No	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	20,938	20,938	20,938	20,938	20,938	20,938
<i>Adjusted R<sup>2</sup></i>	9.40%	25.15%	10.95%	27.04%	10.02%	17.78%
Panel B Operating performance						
	Dependent variable: <i>Salesgrowth</i>		Dependent variable: <i>Capitalgrowth</i>		Dependent variable: <i>Incomegrowth</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Residualpost</i>	15.010*** (3.197)	18.089*** (4.826)	−8.054 (−0.222)	4.522 (0.162)	44.960*** (3.859)	46.273*** (4.212)
<i>Controls</i>	No	Yes	No	Yes	No	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	20,938	20,938	20,938	20,938	20,938	20,938
<i>Adjusted R<sup>2</sup></i>	0.83%	46.98%	0.61%	33.05%	0.68%	14.32%

Note: This table presents whether explanations based on internal governance, operating performance, and cognitive evaluation theory could apply to the positive relation between social media criticisms and earnings management. In Panel A, *Outblock*, *Topshare*, and *Indirector* are employed as the dependent variables to test whether a large number of social media criticisms signal the deterioration in the internal governance of a given firm. In Panel B, *Salesgrowth*, *Capitalgrowth*, and *Incomegrowth* are employed as the dependent variables to test whether a large number of social media criticisms signal the deterioration in the operating performance of a given firm. All variables are defined in Appendix A. T-statistics that are based on standard errors clustered by firms appear in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by \*, \*\*, and \*\*\*, respectively.

(2010) to measure the operating performance of firms. The coefficient of *Residualpost* should be significantly negative if the operating performance explanation has an element of truth. However, what is shown in Panel B of Table 11 is inconsistent with the prediction of the operating performance explanation. To make it concrete, the coefficients of *Residualpost* are positive and significant at the 1% level in most cases, indicating that social media criticisms improve firms' operating performance to some extent. Therefore, the operating performance deterioration fails to explain the positive relation between negative fundamental-related postings and earnings management.

## 5. Conclusions

The advent of social media enables small investors to express their views frequently and forcefully. Whether this is a blessing or curse to corporate governance is indeed a question worth exploring. In this paper, we try to provide an answer by analyzing data from the leading Internet stock message board set in China. The results from OLS regressions, the instrumental variable approach, and the difference-in-differences approach demonstrate that negative fundamental-related postings on Internet stock messages boards could promote earnings management. Additional analyses suggest that a large number of negative fundamental-related postings are not associated with deteriorations in internal governance and operating performance, but confirm that the cognitive evaluation theory (external monitoring can crowd out managers' intrinsic motivation to behave ethically) can explain why individual investors' social media criticisms are positively related to earnings management. Meanwhile, we also find that the positive relation between social media criticisms and earnings management varies with users' levels.

Our study contributes to the existing literature on the impact of social media on financial markets by pointing out that the development of the Internet is a double-edged sword for corporate governance. Previous studies,

such as Ang et al. (2021) and Dube and Zhu (2021), focus on the bright side of social media on corporate governance. They demonstrate that investors' or employees' comments on social media could constrain firms' value-destroying acquisition attempts and improve firms' workplace practices. On the contrary, we highlight the dark side of social media criticisms, i.e. it could aggravate the agency problems. Thus, how to mitigate the bad influence of social media on corporate governance is a valuable question for academics, practitioners, and policymakers to think seriously in the future.

## Notes

1. Please visit <http://guba.eastmoney.com> for more information.
2. Even though our paper documents a dark side of social media in corporate governance, the finding does not contradict that of Ang et al. (2021). This is because they aim to examine the direct effect of investors' social media criticisms, while our research goal is to explore the potential negative 'externality' of social media content.
3. The differences between our conclusions and those of previous literature could be attributed to the differences in research aims. Specifically, Ang et al. (2021) demonstrate that investors' social media criticisms of a given acquisition (i.e., acquisition-related postings) are negatively related to the potential acquisitions that investors consider value-destroying (i.e., those that elicit negative stock market reactions at the time of announcements). In other words, small investors have identified these value-destroying activities and explicitly expressed their opposition to management. Hence, the posting content matches the outcome as they are all related to acquisition attempts. Dube and Zhu (2021) find that after being reviewed on Glassdoor, firms improve their workplace practices. Considering that Glassdoor is a popular social media site for employees to post employer reviews, the effect on firms' employee relations and diversity is also quite straightforward. However, in our setting, we try to offer some evidence of the 'negative externality' of social media content by examining whether investors' criticisms of firm fundamentals can trigger some unintended consequences, i.e., promoting earnings management. To some degree, there is a mismatch between posting content (firm fundamentals) and outcomes (earnings management).
4. Please visit <https://www.szse.cn/aboutus/research/securities/documents/P020180328492550583284.pdf> for more information.
5. A posting entitled 'Dongguan Securities issued risk warnings to its VIPs' in the stock message board of China South Locomotive elicited significant market negative reactions in 2015. However, this has later been proved to be a piece of misinformation. Please consult [https://www.sohu.com/a/59527352\\_115411](https://www.sohu.com/a/59527352_115411) for detailed information.
6. The keywords include profits, operations, sales, expenses, financial reporting, production, equipment, auditing, investment, R&D, mergers, acquisitions, issuance, bonds, loans, etc.
7. The details of the estimations are described in Appendix B. Apart from this measurement, we also employ the models proposed by Dechow and Dichev (2002) and McNichols (2002) to estimate the discretionary accruals in the robustness checks.
8. The detailed definitions of these variables are included in Appendix A.
9. To save space, we suppress the coefficients of control variables in Table 4 and tables hereafter.
10. We also use two instrumental variables based on the CSI 500 index membership and the netizen population in the province where the firm locates. The results are presented in Appendix D.
11. To save space, we introduce the details of these two diagnostic tests in Appendix E.
12. The calculation of the abnormal production costs, the abnormal operating cash flows, and the abnormal discretionary expenses are defined in detail in Appendix C.
13. We thank an anonymous reviewer for this suggestion.
14. Since higher *Retailholding* corresponds to lower institutional ownership, we sort stocks based on the opposite of *Retailholding*.
15. Besides, we also utilize managers' responses to rumors spread on stock message boards to provide further support to the cognitive evaluation theory. The results of the test is reported in Appendix F.

## Disclosure statement

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## Notes on contributors

Yi Li is an assistant professor of Finance at School of Management and Economics, Beijing Institute of Technology. Her research interests include corporate finance, empirical asset pricing, and Fintech.

**Wei Zhang** is the University Chair Professor at College of Management and Economics, Tianjin University. His research interests include financial computing and analytics, FinTech, and asset pricing and risk management. Prof. Zhang has authored over 100 publications appeared in refereed journals, both international and domestic. He sits on several editorial boards of international & domestic journals and was invited to be the guest editor of several special issues of international academic journals. He is currently the Managing Editor of both *Journal of Management Science and Engineering* and *Journal of Management Sciences in China* (in Chinese). He also serves as Co-President for Chinese Academy of Management, Vice-Chairman for China's National Education Advisory Board of Management Science and Engineering.

**Andrew Urquhart** is Professor of Finance and Financial Technology at the ICMA Centre, Henley Business School, University of Reading. Andrew is Head of Department at the ICMA Centre and he has published over 50 papers in world-leading journals such as *Nature*, *Journal of Corporate Finance*, *Journal of Financial Markets*, *European Economic Review* and so on. He is associate editor at the *European Journal of Finance*, *Economic Letters*, *International Review of Financial Analysis* as well as Area Editor for *Fintech at Research in International Business and Finance*.

**Pengfei Wang** is a PhD student at College of Management and Economics, Tianjin University. His research interests include Fintech, big data analytics, and empirical asset pricing.

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