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Business and financial information integration and voluntary management earnings forecasts

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ABSTRACT

In this study, the impact of business and financial information integration (BFII) on the voluntary management earnings forecasts (VMEFs) of listed firms in China between 2008 and 2018 is investigated. Drawing on litigation cost and ability signaling theories, we find that the adoption of BFII encourages top managers to disclose VMEFs. BFII firms are identified through the textual analysis of management discussion and analysis (MD&A) reports, and the empirical results indicate that BFII firms have a higher probability and frequency of issuing VMEFs than non-BFII firms. The results remain robust after we identify causality by applying a propensity score matching and difference-in-differences (PSM-DID) test and use an alternate measure of BFII. Further tests show that BFII firms issue more accurate VMEFs and are able to issue them at an earlier stage. We also find that the positive relationship between BFII and VMEFs is weakened if the media expresses concern about the uncertainty of BFII adoption.

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1. Introduction

Today's increasingly complex business environment makes business and financial information integration (BFII) essential to firms' value creation. BFII, which enables western firms to succeed against fierce global

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competition (Bai et al., 2018; Garicano and Rossi-Hansberg, 2006; Gu et al., 2017; Imbs, 2006; Mendoza et al., 2009), involves removing the boundary between the financial and business departments, improving information integration and connections within a firm, and ensuring that financial information reflects business operations. By adopting BFII, a firm demonstrates its determination to ensure that its financial department is fully aware of daily operations rather than simply functioning as an auxiliary department and enables business departments to make full use of financial information in their decision-making, activity monitoring, and business performance evaluation. Thus, BFII can improve the efficiency of information production and transmission.

BFII is becoming popular worldwide, as it can reduce the mismatch between business operations and financial information. The International Financial Reporting Standards Foundation (IFRS) 15 revised its revenue recognition model in 2014 to improve accounting timeliness and relevance. In 2017, China issued new revenue standards that converged with those of the IFRS, with the aim of making it possible to compare the accounting of different countries. In the area of information comparability and transparency, the new standards require a “five-step” model for revenue and cost recognition, which are measured based on the percentage of completion. Timely and effective communication between financial and business departments is thus required. In this study, we focus on how information integration influences the quality of corporate information disclosure. When recruiting finance personnel, firms that have implemented BFII focus more on operational industry knowledge than those that have not. They are also more likely to insist on rotations of finance personnel into business units, and to use the “percentage to completion” method correctly. The implementation of BFII thus has both theoretical and practical significance for the comparability and standardization of revenue, and hence earnings information.

Although BFII is globally significant in terms of accounting standards and firm operations, its antecedents and consequences have not been fully considered in academic research. This gap may be due to the ambiguous definition of BFII concepts and their confusion with specific managerial tools, or to the difficulty of measuring BFII. Jacobs and Whybark (2000), Giachetti (2004), Gil-Garcia et al. (2009), and Jagoda and Samaranayake (2017) measured it through the use of enterprise resource planning (ERP), but this measure has limitations, because ERP is a computer system that assists in firm operations, whereas BFII is a concept, culture, and strategy for integrating business and financial information. BFII affects every area of a firm, including recruiting, accounting policies, organizational restructuring, information sharing across departments, and management styles.

Thus, we consider BFII as a firm strategy under which the duty of the financial staff is no longer simply the post-accounting supervision of the business. Instead, they predict business trends, calculate daily performance, and feed important information back to other departments. We construct an innovative measure of BFII, based on the textual analysis of the management discussion and analysis (MD&A) that all listed firms are required to release. We thus examine the characteristics of a firm's BFII by analyzing information in its MD&A. Information about executives is disclosed in MD&A, and thus it is a significant component of financial reports. If a firm discloses that it is “adopting BFII,” it is likely that the firm has integrated its business and financial information. In our robustness tests, we attempt to identify BFII by applying the textual analysis to news released on social media. Social media is an external issuer of information, and thus it can be used to monitor firms. Firms in China that adopt BFII are of great interest to the media, particularly when it is promoted by the Ministry of Finance.

The disclosure of voluntary management earnings forecasts (VMEFs) represents an extremely important decision for listed companies, as it can be a double-edged sword. It can optimize the firm's information environment, but can also lead to potential litigation. VMEFs reduce informational asymmetry between firms and investors and thus improve the firms ability to raise capital (Diamond and Verrecchia, 1991) and signal competence (Trueman, 1986). However, if a false statement leads to losses for investors, they can initiate legal proceedings that threaten the listed company (Kasznik, 1999).

The relationship between BFII and VMEFs is supported by litigation cost and ability signaling theories. BFII reduces the information asymmetry between finance and business departments, and protects a firm against claims that it issues misleading information, thus reducing the litigation risk. As the number of claims

against firms has increased, BFII has gradually gained popularity, particularly among listed firms with a higher (perceived) litigation risk. Ability signaling theory suggests that managers provide voluntary disclosures about the firm's operations as a signal of their ability to anticipate changes in the economic environment and to manage the firm effectively (Trueman, 1986). BFII firms have the advantage of integrating information from different departments, and managers are thus likely to be more aware of firm operations and more able to predict future earnings. They signal this ability to investors through the issuance of VMEFs.

We identify causality between BFII and VMEFs by applying a difference-in-differences methodology. After controlling for potential endogeneity, we observe that BFII has a positive and significant impact on the probability and frequency of VMEF disclosures, and that BFII firms are associated with more accurate and timelier VMEFs than non-BFII firms.

Our study makes three main contributions to the literature. First, we extend studies of management earnings forecasts (MEFs) that explore the determinants of information disclosure, including litigation risk (e.g., Bourveau et al., 2018; Brown et al., 2005; Cao and Narayanamoorthy, 2011; Field et al., 2005; Francis et al., 1994; Houston et al., 2019; Johnson et al., 2001; Rogers and Buskirk, 2009; Skinner, 1994, 1997; Wynn, 2008), legal environment (Baginski et al., 2002), and analyst and investor environment (Ajinkya et al., 2005; Anilowski et al., 2007; Healy and Palepu, 2001). However, information integration has rarely been considered in MEFs. We extend this research by examining the effect of BFII, and suggest that information integration is an essential factor in the issuance of VMEFs. As indicated in other studies, the integration of team members confirms common values, reduces communication costs, and enhances synergy (Bizjak et al., 2009; Certo et al., 2006; Fracassi and Tate, 2012; Larcker et al., 2011). Our research results confirm the importance of information integration in corporate information disclosure decisions, and thus supplement previous findings on the determinants of information disclosure.

Second, we extend the research on the economic consequences of information integration by considering the perspective of disclosure incentives. Most studies of the economic consequences of information integration focus on capital operations, such as capital markets, investment mergers and acquisitions (M&A), and supply chains (e.g., Dhaliwal et al., 2013), rather than information disclosure. Information integration has a more direct transformative effect on the production and transmission of company information than on M&A or the supply chain.

Third, we use textual analysis to identify whether and when firms introduce BFII. This innovative method uses the MD&A text (see the management discussion and analysis section) in firms' annual reports. We establish a database on the implementation of BFII through this process, thus enabling a comprehensive analysis of the economic consequences of BFII. In addition, we verify whether a company's goals are achieved through BFII by manually collecting relevant media coverage from leading newspapers and websites. This third-party evidence provides the basis for our objective evaluation of BFII. Thus, we obtain a direct measurement of BFII that can be used in future research.

The remainder of this paper is organized as follows. Section 2 presents a discussion of information disclosure and BFII in China. Section 3 presents our hypothesis development. The research design is discussed in Section 4. Section 5 reports the main empirical results. The endogeneity of BFII is addressed in Section 6. Section 7 provides further analysis and Section 8 concludes the paper.

2. Institutional background

2.1. Information disclosure in China

The emerging economy of China developed its capital markets relatively recently. The opening of the Shanghai and Shenzhen Stock Exchanges in December 1990 represented China's most significant steps toward market-oriented reform (Jiang and Kim, 2015). The China Securities Regulatory Commission (CSRC) is the main securities regulator, which notes that firms listed on the two exchanges should have similar financial reporting and disclosure rules. According to Article 2 of the *Regulations on Information Disclosure for China's*

Listed Companies issued by CSRC in 2007, listed firms should “disclose information truly, accurately, completely, and timely” and that it is unlawful “to make any untrue and misleading statement of a material fact or to omit to state a material fact.”¹

According to the rules and regulations issued by Chinese Stock Exchanges and the CSRC, Chinese listed companies are required to disclose earnings forecasts in the following circumstances: (1) if they report losses; (2) if their earnings increase or decrease by more than 50% relative to earnings during the same period of the previous year; and (3) if they change from losses to profits for the whole year, half-year, or the third quarter. The forecasting company, along with its executives and directors, may be publicly denounced by the stock exchanges if mandatory forecasts are omitted or delayed.

Firms are otherwise encouraged to release earnings forecasts voluntarily. Penalties are imposed by the stock exchanges if misleading voluntary forecasts are issued.

In many countries such as the U.S., firms are encouraged to provide information about expected earnings (Hirst et al., 2008) regardless of VMEFs. Market traders seeking private information can use VMEFs and financial reports to optimize their investments. The information environment of China’s capital markets is less developed than other mature markets (Piotroski and Wong, 2012), and both the motivation to disclose VMEFs and the potential penalties are lacking for Chinese listed companies. The optimization of the information environment is therefore extremely challenging. Thus, by examining the motivations for issuing VMEFs, new insights into how to mitigate the information asymmetry that characterizes the China stock market may be revealed.

2.2. BFII adoption in China

The Chinese Ministry of Finance encourages BFII as part of the broader integration of global business and financial information. Increasingly, firms are realizing the significance of BFII, and the proportion of firms adopting it has grown since 2008. Exploring BFII from VMEFs can provide insights into information disclosure in China’s capital market. Investors in emerging economies such as China face much uncertainty due to high information asymmetry (Zhang, 2006). According to institutional theory information disclosure is critical for firms seeking to gain a competitive advantage in capital markets, particularly in emerging economies that lack independent financial intermediaries and in which resource allocation depends on the government (Zhou et al., 2017).

The BFII of Chinese firms provides a unique context, as there are many differences between China and Western countries. In Western countries, changes in the business environment are implemented through system and process controls, whereas Chinese firms rely on a “leadership culture” (Graham et al., 2012, 2013) in which strict power divisions exist among departments. The leaders of each department perform their duties according to their levels of expertise, and have limited access to other departments. China’s leadership culture offers an appropriate institutional setting for studying the influence of BFII. In addition, the adoption of the new 2017 revenue recognition standards requires firms to recognize revenues and costs according to completion rates, which leads to the further integration of business and financial information.

Thus, research into BFII in the capital markets of emerging economies such as China not only improves our understanding of information disclosure but also examines the role of accounting standards and practices.

3. Hypothesis development

VMEF disclosure is the process of combining information so that forward-looking earnings can be predicted (Kwak et al., 2012; Yhim et al., 2003). Executives may often not fully understand information from departments that are not within their areas of specific expertise. Thoroughly integrating expertise from business and finance departments is increasingly required in many firms, as complex business environments require comprehensive information for decision-making. Thus, firms may be more likely to adopt BFII when the

¹ Information for *Regulations on Information Disclosure for China’s Listed Companies* can be checked at the official website: http://www.csrc.gov.cn/pub/newsite/ssb/ssflfg/bmgzjwj/ssxxpl/200911/t20091111_167865.html (in Chinese)

information environment is opaque, when the firm is growing, or when business operations become more diverse. Adopting BFII indicates that a firm is attempting to integrate business and financial information and to combine the expertise of the two departments. Unsurprisingly, the number of firms adopting BFII continues to increase, particularly since the Ministry of Finance published its documents and guidelines regarding BFII in 2014 and 2016.

Two major changes occur when firms adopt BFII: (a) information asymmetry between the business and financial departments is reduced, and their communication efficiency improves; and (b) future earnings increases can be forecast. The integration of business and financial information also leads to the recruitment of employees with both business and financial experience, more job rotations within the firm, and the application of a percentage-of-completion methodology for recognizing revenues and costs. In contrast, for non-BFII firms, the accounting figures from their financial departments do not fully reflect daily operations, and the business department may find it difficult to use the financial information when optimizing their decisions. This information asymmetry between departments in non-BFII firms makes forecasting earnings challenging.

Studies on corporate disclosure suggest that firms voluntarily issue earnings forecasts for various reasons, such as to gain access to external finance, to reduce the risk of management dismissal and hostile takeovers, and to communicate with analysts (Dai et al., 2005; Diamond and Verrecchia, 1991; Healy and Palepu, 2001; Verrecchia, 1983). Two other motives are closely related to the role of BFII: litigation costs and ability signaling. Investors can initiate legal action against managers who provide misleading information (Bamber and Cheon, 1998). A firm facing lawsuits generally experiences a major loss in value. VMEF litigation not only imposes substantial costs in terms of lost time and money (Kasznik, 1999), but also in terms of intangibles such as the reputation and prestige of its managers. The risk of litigation therefore justifiably deters firms from issuing biased earnings forecasts. After a firm adopts BFII, its business and financial departments become more closely connected. Financial departments in non-BFII firms are focus on financial practices, whereas those in BFII firms have an understanding of business operations. Business departments can also use the information embedded in accounting figures to support decision-making, monitoring, and feedback in their daily activities. We argue that such a reduction in information asymmetry between the business and financial departments is particularly important when issuing VMEFs. Executives in BFII firms have access to integrated information, which allows them to manage their firms more effectively, through better control of future cash flows, earnings per share, and discount rates. The familiarity theory examines the behavioral biases of people and shows that their decision-making processes involve heuristic simplification (Massa and Simonov, 2006). When financial and business departments communicate, they gradually come to share a common language, and the increasing familiarity leads to further information integration as the trust between the two groups increases (Custódio and Metzger, 2014). As suggested in other studies, an information advantage enables firms to issue more accurate earnings forecasts (e.g., Hurwitz, 2017; Kwak et al., 2012), and the increased accuracy reduces potential litigation costs. Thus, information asymmetry and unfamiliarity will deter non-BFII firms from issuing a VMEF due to concerns of potential litigation (Cao and Narayanamoorthy, 2011; Trueman, 1986), whereas BFII firms are more likely to issue VMEFs because they face fewer litigation risks.

The ability signaling theory suggests that voluntarily issuing a management earnings forecast is viewed as a test of the abilities of managers (Baik et al., 2011), who signal to investors their competence in anticipating changes in the economic environment and managing the organization. Investors infer executives' ability through their management earnings forecasts (Baik et al., 2011). After BFII is adopted, executives become more confident in the accuracy of their estimates of future earnings. However, non-BFII firms may experience risk information asymmetry and potential distrust between the financial and business departments.

To summarize, based on litigation theory and ability signaling theory, we propose that BFII firms are more likely to issue a VMEF than non-BFII firms.

Hypothesis: *Ceteris paribus*, firms that adopt BFII have a higher propensity for and frequency of VMEFs than non-BFII firms.

4. Methodology

4.1. Sample selection

We obtain BFII adoption announcements from firm's MD&A reports, and third-party evaluations of the BFII adoptions from China's leading financial media. We apply textual analyses to both these datasets. The sample includes all A-share public firms listed in the Shanghai and Shenzhen Stock Exchanges in China between 2008 and 2018. Our sample starts in 2008, as this is when the new Accounting Standards for Business Enterprises were applied. Since 2008, Chinese listed companies have been required to disclose earnings forecasts if the predicted performance reaches the required thresholds. We collect management earnings forecast data and other financial data from the China Stock Market and Accounting Research (CSMAR) database. This database is widely used in accounting studies (Chen et al., 2018; Li et al., 2016). We exclude firms that (a) are in the financial industry; (b) are required to disclose management earnings forecasts, and (c) have missing values for key variables. The final sample for our baseline regression contains 14,443 firm-year observations.

4.2. Variable measurement

4.2.1. Measuring business and financial information integration (BFII)

We use textual analysis to collect business and financial information integration data from MD&A sections of financial reports. MD&A reduces information asymmetry between firms and stakeholders by providing stakeholders with supplemental information (Bryan, 1997). China introduced MD&A disclosure in 2001, and a series of modifications have been applied in subsequent years. For example, "review and prospect of operating" was replaced by "management discussion and analysis" in 2003. Chinese listed firms are required to reveal and analyze important information about their operations. They also disclose their forecasts for future development, risks, opportunities, and challenges in the MD&A. We extract the MD&A sections from quarterly, semi-annual, and annual financial reports. We then analyze the content to identify whether the firm uses BFII. The details of the MD&A and BFII identification are presented in Appendix 1. We define BFII as a dummy variable that equals one (1) if a firm adopts BFII in year t and the following years. BFII equals zero (0) if a firm never adopts BFII or if the firm has not yet adopted BFII.

4.2.2. Measurements of voluntary management earnings forecast (VMEF) and other control variables

To examine whether BFII influences the probability that firms issue VMEFs, we construct a dummy variable *Dummy_Forecast*, which equals one (1) if a firm releases at least one earnings forecast voluntarily in year $t + 1$ and zero (0) otherwise. We also compute the frequency of VMEF issuance (*Forecast_Frequency*) by counting the number of voluntary earnings forecasts issued in year $t + 1$.

Following the literature, we control for a set of firm and industry characteristics. All of the control variables are measured for a firm in year t . These include firm size (the natural logarithm of the book value of total assets), firm leverage (the book value of total debts divided by the book value of total assets), the number of directors on the board, firm profitability (the ratio of net profit divided by the book value of total assets), cash holdings (cash and cash equivalent scaled by book value of total assets), ownership type (whether a firm is owned by the government), firm age (number of years since the listing year), shareholder concentration (concentration index of shares owned by the three main shareholders), and industry competition (the Herfindahl-Hirschman Index). Panel A of Table 1 provides the definitions of the variables.

4.3. Summary statistics

To mitigate the effect of outliers, we winsorize the continuous variables at the 1st and 99th percentiles. Panel A of Table 1 provides the summary statistics of the variables. On average, 52.3% of the observations have issued VMEFs. Firms issue four VMEFs at most. Only 1.4% of the observations have adopted BFII. As for the other variables, the average natural log of total assets is 21.884, average firm leverage is 0.451, average ROA is 3.4%, average natural log of number of board members is 2.280, average cash and cash equivalents

Table 1

Definition of variables and summary statistics. This table provides the definitions of variables and summary statistics for a sample of Chinese A-share listed firms between 2008 and 2018. Panel A provides the variable definitions. Panel B reports the summary statistics for the variables in Panel A.

Panel A: Variable definition

Variables	Definitions
Dependent variables	
<i>Dummy_Forecast</i>	A dummy variable that equals one (1) if a listed firm releases at least one earnings forecast voluntarily in year $t + 1$ and zero (0) otherwise
<i>Forecast_Frequency</i>	The number of VMEFs that a listed firm releases in year $t + 1$
Independent variables	
<i>BFII</i>	A dummy variable that equals one (1) if a firm adopts BFII in year t and the following years and zero (0) otherwise
Control variables	
<i>Firmsize</i>	Firm size, calculated by the natural logarithm of the book value of total assets in year t
<i>Leverage</i>	Financial leverage, calculated by the book value of total debts divided by the book value of total assets in year t
<i>Boardsize</i>	Board size, which is the logarithm value of the number of directors in a firm's board in year t
<i>ROA</i>	Return on assets, calculated as the ratio of net profit divided by the book value of total assets in year t
<i>Cash</i>	Cash and cash equivalents scaled by the book value of total assets in year t
<i>SOE</i>	A dummy variable that equals one (1) if the ultimate controlling shareholder of a listed firm is the state in year t and zero (0) otherwise
<i>Listage</i>	Listing age of a firm, calculated as the difference of fiscal year t minus the year the firm was listed
<i>Top3</i>	The concentration index of shares owned by the largest three shareholders in year t
<i>Competition</i>	The Herfindahl-Hirschman Index of the industry

Panel B: Summary statistics

Variable	mean	sd	min	median	max
<i>Dummy_Forecast</i>	0.523	0.499	0.000	1.000	1.000
<i>Forecast_Frequency</i>	0.624	0.664	0.000	4.000	4.000
<i>BFII</i>	0.014	0.116	0.000	0.000	1.000
<i>Size</i>	21.884	1.382	18.938	21.707	27.293
<i>Lev</i>	0.451	0.212	0.032	0.367	0.990
<i>ROA</i>	0.034	0.067	−0.640	0.046	0.429
<i>Boardsize</i>	2.280	0.194	0.000	2.302	3.135
<i>Cash</i>	0.184	0.141	0.000	0.163	0.844
<i>Listage</i>	8.803	6.476	0.000	1.946	28.000
<i>SOE</i>	0.454	0.498	0.000	0.000	1.000
<i>TOP3</i>	0.171	0.125	0.010	0.131	0.618
<i>Competition</i>	0.951	0.077	0.000	0.983	0.991

is 18.4%, average firm age is 8.803, 45.4% of the observations are stated-owned enterprises, the average concentration index of the largest three shareholders is 17.1%, and the average competition intensity is about 0.951.

Table 2 reports the distribution of firms that adopt BFII. The number of firms adopting BFII has increased year-on-year since 2013. The Ministry of Finance issued a guidance document in 2014 for the construction of comprehensive management accounting systems, which notes that integrating financial and business activities to provide information for decision-making, control, and evaluation of firms is a significant component of accounting. In 2016, the Ministry of Finance issued the Guidance of Managerial Accounting document, which proposes that firms should integrate financial and business information, thus providing management with timely and relevant strategic information. Between 2013 and 2018, the number of firms increases incrementally year by year and by 2018, 251 firms had adopted BFII, accounting for 6.99% of all A-share listed firms.

5. Baseline empirical results

We estimate the influence of BFII on the propensity and frequency of VMEF using Models (1) and (2).

$$Dummy_Forecast_{i,t+1} = \alpha + \beta * BFII_{i,t} + \gamma * Z_{i,t} + \varepsilon_{i,t} \quad \text{and} \quad (1)$$

$$Forecast_Frequency_{i,t+1} = \alpha + \beta * BFII_{i,t} + \gamma * Z_{i,t} + \varepsilon_{i,t}, \quad (2)$$

where i represents the firm and t represents year. In Model (1), the dependent variable captures the probability of issuing a VMEF. A dummy variable equals one (1) if firm i issues at least one VMEF in year $t + 1$ and zero (0) otherwise. In Model (2), the dependent variable is used to assess the frequency of VMEF. The independent variable BFII is a dummy variable indicating whether firm i adopts BFII in year t . Z is the vector of all control variables. The process of adopting BFII takes about one year, so we measure VMEF in year $t + 1$. We control for year and industry fixed effects. Standard errors are clustered at the firm level.

Table 3 reports the results of the effect of BFII on VMEF. The dependent variable in column (1) is the probability of issuing a VMEF. The coefficient of $BFII$ is 0.052 (P-value < 0.05), which indicates that managers in firms that adopt BFII have a higher probability of issuing VMEF than those that do not adopt BFII. In column (1), the coefficient of $BFII$ is 0.286 (P-value < 0.001), which indicates that when firms adopt BFII, managers issue VMEFs more frequently. These results are consistent with litigation theory and ability signaling theory. The increased communication and trust after adopting BFII leads to the integration of financial and business information. Executives become more confident about their ability and signal this confidence by issuing earnings forecasts voluntarily.

6. Endogeneity

To reduce the likelihood of endogeneity, we apply propensity score matching (PSM) and difference-in-differences (DID) methods. We first use 1:1 propensity score matching with non-replacement to identify the control sample. We use the one-year lagged value of all of the control variables in Model (1) to match a treated sample with a control sample. We obtain 154 treatment firms and 154 control firms. Panel A in Table 4 provides covariate balance checks for both samples. None of the differences between the matching variables are significant.

We then design a DID model to compare the probability and frequency of voluntary earnings forecasts between treated and control firms over a three-year observation window. In Models (3) and (4), $Post$ is a dummy variable that equals one (1) if the observation is in or after the years when the firms adopts BFII and zero (0) otherwise. The variable of interest is the interaction item of $BFII$ and $Post$.

$$Dummy_Forecast_{i,t+1} = \alpha + \beta * BFII_{i,t} + \delta * BFII_{i,t} * Post + \theta * Post + \gamma * Z_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$Forecast_Frequency_{i,t+1} = \alpha + \beta * BFII_{i,t} + \delta * BFII_{i,t} * Post + \theta * Post + \gamma * Z_{i,t} + \varepsilon_{i,t} \quad (4)$$

Panel B in Table 4 provides the DID regression results of Models (3) and (4). In columns (1) and (2), we control for year and industry fixed effects. In columns (3) and (4), we control for year and firm fixed effects to mitigate the influence of time-invariant omitted firm characteristics. In column (1), the coefficient of $BFII *$

Table 2
Distribution of firms adopting BFII.

Year	Incremental number of firms that adopt BFII (A)	Cumulative number of firms that adopt BFII (B)	Number of A-share-listed firms (C)	Column (B)/Column (C)
2008	1	3	1,603	0.19%
2009	3	6	1,752	0.34%
2010	3	9	2,107	0.43%
2011	9	18	2,341	0.77%
2012	1	19	2,470	0.77%
2013	6	25	2,515	0.99%
2014	13	38	2,633	1.44%
2015	22	60	2,824	2.12%
2016	40	100	3,119	3.21%
2017	53	153	3,496	4.38%
2018	98	251	3,590	6.99%

Post is 0.055 ($P\text{-value} < 0.05$). This indicates that for firms that adopt BFII, managers have a higher probability of issuing VMEF than firms that do not adopt BFII. In column (2), the coefficient of *BFII* Post* is 0.072 ($P\text{-value} < 0.05$). This indicates that managers of firms that adopt BFII issue VMEF more frequently than those that do not adopt BFII. In columns (3) and (4), the interactive item is significantly positive, showing that the results also hold after controlling for time-invariant omitted firm characteristics. After using PSM and DID to control for potential endogeneity problems, our hypothesis that BFII firms have a higher probability and frequency to issue a VMEF is supported.

7. Further analyses

7.1. Impact of BFII on the properties of VMEFs

Our empirical results indicate that firms that have adopted BFII are more likely than firms that have not adopted BFII to issue VMEF and to issue them more frequently. In this subsection, we further examine the influence of BFII on the properties of VMEFs, including forecast accuracy and forecast horizon. Firms with BFII are more likely to issue more accurate VMEF than those without, because of the increased confidence and ability of their managers. Accurate forecasts demonstrate a manager's confidence in a firm's prospects and operational stability and risk, and this may lead to higher share prices (Lees, 1981). As BFII can help executives to share information, we argue that firms with BFII produce more accurate VMEFs.

In addition, firms with BFII are able to issue VMEFs earlier than firms without BFII. Information uncertainty, which is mainly due to fluctuations in firm fundamentals or limited information (Zhou et al., 2014), is closely related to firms' business and operating environment (Jiang et al., 2005). Information uncertainty increases as the horizon of forecasted future earnings becomes longer. BFII leads to a more accurate reflection of accounting figures. Executives in the financial and business departments can thus gather more accurate information and make better judgments about future earnings.

To examine the influence of BFII on the accuracy and horizons of VMEFs, we construct two measures. The first is *EPS_Accuracy*, which indicates the accuracy of earnings per share (EPS) forecasts. This is calculated as the absolute value of the difference between the predicted and real EPS divided by the real value and then multiplied by (-1). The larger the value of *EPS_Accuracy*, the more accurate a VMEF. The second measure is *Forecast_Gap*, a variable indicating the forecast gap between the date that managers issue a VMEF and the predicted date. The earlier the earnings forecast is released, the greater the value of *Forecast_Gap*. We estimate the influence of BFII on the accuracy and horizons of VMEFs using Models (5) and (6).

$$EPS_Accuracy_{i,t+1} = \alpha + \beta * BFII_{i,t} + \delta * BFII_{i,t} * Post + \theta * Post + \gamma * Z_{i,t} + \varepsilon_{i,t} \quad (5)$$

$$Forecast_Gap_{i,t+1} = \alpha + \beta * BFII_{i,t} + \delta * BFII_{i,t} * Post + \theta * Post + \gamma * Z_{i,t} + \varepsilon_{i,t} \quad (6)$$

Table 3

Baseline Regression of BFII's Impact on VMEF. Column (1) reports the influence of BFII on firms' probability of issuing a VMEF. The dependent variable is *Dummy_Forecast*. Column (2) reports the influence of BFII on firms' VMEF frequency. The dependent variable is *Forecast_Frequency*. *BFII* equals one (1) if a firm adopts BFII in year *t* and the following years and zero (0) otherwise. Firm-level characteristics include the logarithm of total assets (*Size*), firm leverage (*LEV*), firm profitability (*ROA*), board size (*Boardsize*), firm cash holdings (*Cash*), firm age (*Listage*), firm property right (*SOE*), and ownership concentration (*TOP3*). At the industry level, we control for industry competition (*Competition*). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	(1) <i>Dummy_Forecast</i>	(2) <i>Forecast_Frequency</i>
<i>BFII</i>	0.052** (2.25)	0.286*** (2.76)
<i>Size</i>	0.001 (0.24)	−0.035** (−2.20)
<i>Lev</i>	−0.136*** (−6.73)	−0.580*** (−6.45)
<i>ROA</i>	0.028 (0.46)	−1.414*** (−5.19)
<i>Boardsize</i>	0.023 (1.06)	−0.031 (−0.32)
<i>Cash</i>	0.047** (2.04)	−0.153 (−1.50)
<i>Listage</i>	−0.077*** (−18.34)	−0.437*** (−23.45)
<i>SOE</i>	−0.116*** (−14.52)	−0.614*** (−17.31)
<i>TOP3</i>	−0.045 (−1.61)	−0.358*** (−2.85)
<i>Competition</i>	−0.158 (−1.55)	−0.504 (−1.11)
<i>Constant</i>	0.983*** (8.21)	5.220*** (9.78)
Year and industry fixed effects	Yes	Yes
Observations	14,443	14,443
Pseudo R^2 /Adj. R^2	0.458	0.420

Table 5 reports the regression results. In column (1), the coefficient of *BFII* is 0.030 (P-value < 0.05), indicating that firms that adopt BFII issue more accurate VMEFs than firms that do not adopt BFII. In column (2), the coefficient of *BFII* is 12.638 (P-value < 0.05), indicating that managers in firms that adopt BFII issue VMEFs earlier than managers in firms that do not adopt BFII.

7.2. Measuring BFII based on media coverage

We next use an alternative measure of BFII to avoid measurement errors. First, we collect news items that contains keywords such as “business and financial information integration” from both online news sources and newspapers in the 2008 to 2018 period. We then link these news items to specific A-share public firms using stock codes and firm names. We can thus identify whether and when firms adopt BFII. The details of our newspaper searches are presented in Appendix 2. *BFII_Media* is a variable that equals one (1) if the firm adopts BFII in year *t* and the following years based on public media information. The results are reported in Table 6. Columns (1)–(4) present the results of the influence of BFII on the probability, frequency, accuracy, and forecast horizon of a firm's VMEF. The coefficients of *BFII_Media* are similar to the results when *BFII* is constructed based on MD&A. In particular, if a firm adopts BFII, the probability and frequency of issuing VMEFs is found to increase. A firm with BFII can also predict earnings more accurately and earlier than firms without BFII.

Table 4

PSM and DID results. This table provides the covariate balance checks and DID regression results. Panel A reports the covariate balance checks of the 1:1 propensity score matching. The matching variables include the logarithm of total assets (*Size*), firm leverage (*LEV*), firm profitability (*ROA*), board size (*Boardsize*), firm cash holdings (*Cash*), firm age (*Listage*), firm property right (*SOE*), ownership concentration (*TOP3*), and industry competition (*Competition*). Panel B reports the DID regression results of Models (3) and (4). The dependent variables are *Dummy_Forecast* and *Forecast_Frequency*. *BFII* equals one if a firm adopts BFII in year *t* and the following years and zero (0) otherwise. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Covariate balance checks of BFII firms and control firms

Variable	Means <i>t</i> -test			
	BFII firms	Control firms	<i>t</i> -values	<i>p</i> > <i>t</i>
<i>Size</i>	23.112	23.024	0.660	0.510
<i>Lev</i>	0.495	0.488	0.420	0.676
<i>ROA</i>	0.050	0.046	1.180	0.240
<i>Boardsize</i>	2.289	2.292	−0.190	0.848
<i>Cash</i>	0.189	0.173	1.410	0.158
<i>Listage</i>	11.914	12.305	−0.760	0.449
<i>SOE</i>	0.441	0.441	0.000	1.000
<i>TOP3</i>	0.186	0.175	0.980	0.326
<i>Competition</i>	0.956	0.956	0.930	0.126

Panel B: DID regression

Dependent variable	(1)	(2)	(3)	(4)
	<i>Dummy_Forecast</i>	<i>Forecast_Frequency</i>	<i>Dummy_Forecast</i>	<i>Forecast_Frequency</i>
<i>BFII</i>	0.016 (0.20)	0.130 (1.27)	−0.042 (−0.67)	0.074 (0.88)
<i>BFII*Post</i>	0.055** (1.97)	0.072** (2.16)	0.033* (1.73)	0.052** (2.01)
<i>Post</i>	0.001 (0.04)	−0.011 (−0.44)		
<i>Size</i>	−0.040 (−0.73)	−0.035 (−0.82)	0.006 (0.12)	−0.045 (−0.72)
<i>Lev</i>	−0.012 (−0.04)	−0.153 (−0.52)	−0.066 (−0.24)	0.073 (0.19)
<i>ROA</i>	−3.634*** (−3.64)	−3.791*** (−5.03)	−0.927 (−1.61)	−1.612** (−2.06)
<i>Boardsize</i>	−0.092 (−0.34)	−0.305 (−1.00)	−0.143 (−0.62)	−0.362 (−1.17)
<i>Cash</i>	−0.305 (−0.83)	−0.433 (−1.55)	−0.013 (−0.05)	0.006 (0.02)
<i>Listage</i>	−0.032*** (−3.22)	−0.032*** (−4.05)	0.011 (0.56)	−0.019 (−0.70)
<i>SOE</i>	−0.573 (−0.61)	−0.869 (−1.11)	0.130 (0.23)	0.436 (0.56)
<i>TOP1</i>	0.362 (1.03)	−0.078 (−0.26)	−0.176 (−0.43)	0.617 (1.12)
<i>Competition</i>	−1.815** (−2.16)	−0.371 (−0.30)	−1.075 (−1.32)	1.184 (1.08)
<i>Constant</i>	3.316*** (2.58)	3.564*** (2.68)	3.316*** (2.58)	3.564*** (2.68)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes		
Firm fixed effects			Yes	Yes
Observations	489	477	489	477
Pseudo <i>R</i> ² /Adj. <i>R</i> ²	0.288	0.312	0.056	0.065

7.3. Mediating role of social media tone

We use newspapers and website news to analyze the attitudes of social media users toward firms' adoption of BFII. In the sub-sample of BFII firms, we conduct a textual analysis of social media posts. We establish a dictionary containing 227 words related to uncertainty, such as “it depends on,” “not defined,” “somewhere,” and “seem.” We then count how many of these “uncertainty” words are contained in each news item. Next, we divide the number of “uncertainty” words by the total number of words in that news item (*Uncertainty*). The greater the value of *Uncertainty*, the more uncertain social media is about the prospect of BFII adoption.

We construct the interactive item *BFII*Uncertainty* to test the mediating role of social media tone. Social media can be viewed as an external corporate governance channel that monitors firm behavior (Joe et al., 2009). Doubts expressed on social media about a BFII process is a signal that the process faces obstacles. In firms where the adoption of BFII is accompanied by uncertainty, the frequency of VMEFs is likely to be lower. Table 7 reports the mediating role of social media tone. The *Uncertainty* item is omitted because of collinearity. The coefficients of BFII are negative in columns (1) and (2), but the coefficient of the interactive item is significantly positive. These results show that the higher the uncertainty about the BFII adoption process, the less frequently the firm issues a VMEF.

Table 5

Influence of BFII on the accuracy and horizons of VMEFs. This table reports the regression results of Models (5) and (6). The dependent variables are *EPS_Accuracy* and *Forecast_Gap*. *BFII* equals one (1) if a firm adopts BFII in year *t* and the following years and zero (0) otherwise. Control variables include the logarithm of total assets (*Size*), firm leverage (*LEV*), firm profitability (*ROA*), board size (*Boardsize*), firm cash holdings (*Cash*), firm age (*Listage*), firm property right (*SOE*), ownership concentration (*TOP3*), and industry competition (*Competition*). Panel B reports the DID regression results of Models (3) and (4). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1) <i>EPS_Accuracy</i>	(2) <i>Forecast_Gap</i>
<i>BFII</i>	0.030** (2.40)	12.638** (2.19)
<i>Size</i>	0.003*** (3.72)	−4.836*** (−7.93)
<i>Lev</i>	0.003 (0.44)	11.682*** (3.09)
<i>ROA</i>	0.135*** (6.12)	−144.517*** (−12.26)
<i>Boardsize</i>	−0.003 (−0.88)	−13.383*** (−3.81)
<i>Cash</i>	0.010 (1.31)	6.103 (1.36)
<i>Listage</i>	0.006** (2.36)	−15.843*** (−10.52)
<i>SOE</i>	−0.000 (−1.01)	0.009 (0.08)
<i>TOP1</i>	0.019*** (3.15)	−35.918*** (−6.70)
<i>Competition</i>	−0.032 (−1.18)	113.554*** (4.86)
<i>Constant</i>	−0.031 (−1.12)	52.006** (2.14)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Observations	1,014	15,646
Adjusted <i>R</i> ²	0.091	0.324

8. Conclusion

In this study, we examine the impact of business and financial information integration on firms' VMEFs. The empirical results for the baseline model show that firms that adopt BFII have a higher probability and frequency of issuing VMEFs. To identify the causal relationship, we introduce the DID approach and find that the probability and frequency of issuing VMEFs significantly increases for firms that switch from non-BFII to BFII. In addition, we examine the quality of the VMEF. Using the VMEF sub-sample, we find that firms with BFII issue more accurate VMEFs than firms without BFII. They can also predict earnings in a timelier manner. Our findings are consistent with litigation cost theory and ability signaling theory.

Our study contributes to the literature on BFII and information disclosure, and more generally to the literature on corporate governance. The motivation to disclose earnings forecast information for Chinese listed companies is relatively low, but our study identifies a new motivation that can more effectively encourage VMEFs. Forecast disclosure reduces the information asymmetry between managers and investors (Dai et al., 2005), and consequently improves a firm's informational environment (Dorantes et al., 2013). VMEFs have an important role in earnings forecasts in China, so our findings make an important contribution to the literature.

Our study has various implications. First, listed companies should realize the importance of information integration, and their adoption of BFII should not be a mere formality. Second, investors should consider the tone used in reports about firms' BFII in the public media, as well as BFII announcements in the MD&A sections of annual reports. Third, policymakers should combine the guidance on corporate informa-

Table 6

Influence of BFII on the Probability, Frequency, Accuracy, and Forecast Horizon of VMEFs: BFII Measured Using News Information. This table reports the regression results the influence of BFII on the probability, frequency, accuracy, and forecast horizon of VMEF when BFII is measured using news information. The dependent variables are *Dummy_Forecast*, *Forecast_Frequency*, *EPS_Accuracy*, and *Forecast_Gap*. *BFII* equals one (1) if a firm adopts BFII in year *t* and the following years and zero (0) otherwise. *BFII* is measured by news information. Control variables include the logarithm of total assets (*Size*), firm leverage (*LEV*), firm profitability (*ROA*), board size (*Boardsize*), firm cash holdings (*Cash*), firm age (*Listage*), firm property right (*SOE*), ownership concentration (*TOP3*), and industry competition (*Competition*). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1) <i>Dummy_Forecast</i>	(2) <i>Forecast_Frequency</i>	(3) <i>EPS_Accuracy</i>	(4) <i>Forecast_Gap</i>
<i>BFII_Media</i>	0.051*** (5.34)	0.278*** (6.55)	0.034** (2.08)	4.396* (1.65)
<i>Size</i>	0.001 (0.33)	−0.031** (−2.07)	0.011* (1.88)	−8.537*** (−9.71)
<i>Lev</i>	−0.110*** (−5.51)	−0.435*** (−4.95)	−0.099*** (−2.80)	5.257 (1.09)
<i>ROA</i>	0.083 (1.38)	−1.100*** (−4.14)	1.001*** (6.88)	−54.979*** (−3.00)
<i>Boardsize</i>	0.003 (0.19)	−0.110 (−1.45)	−0.069** (−2.36)	−14.657*** (−3.68)
<i>Cash</i>	0.071*** (3.20)	−0.018 (−0.18)	−0.039 (−0.84)	33.348*** (7.00)
<i>Listage</i>	−0.016*** (−27.93)	−0.091*** (−36.12)	−0.003** (−2.47)	0.261 (1.64)
<i>SOE</i>	−0.080*** (−10.05)	−0.413*** (−11.73)	0.013 (1.01)	−8.871*** (−4.61)
<i>TOP3</i>	−0.076*** (−2.84)	−0.520*** (−4.41)	0.085* (1.75)	−30.295*** (−5.00)
<i>Competition</i>	−0.164* (−1.75)	−0.582 (−1.41)	−0.030 (−0.16)	6.354 (0.31)
<i>Constant</i>	0.989*** (9.29)	5.099*** (10.86)	−0.180 (−0.89)	176.276*** (6.92)
Year and industry fixed effects	Yes	Yes	Yes	Yes
Observations	14,445	14,445	1,160	11,748
Pseudo R^2 / Adj. R^2	0.474	0.448	0.106	0.329

tion disclosure and BFII adoption. Finally, analysts should monitor BFII adoption by company executives, as it can inform their evaluations of the information quality of VMEFs.

Our study has three main limitations that can be addressed in future research. First, the self-selection problem may lead to endogeneity issues, i.e., the decision to adopt BFII may not be purely exogenous. Thus, the relationship we find between BFII adoption and VMEF may be explained by self-selection. We address this concern by applying a PSM and DiD approach. Second, a cumulative number of 251 firms adopted BFII between 2008 and 2018, which is only a small proportion of Chinese listed firms, and this may affect the stability of our causal inference. Fortunately, the number of BFII firms is increasing rapidly, so future examinations of business and financial information integrations can validate our results with a larger sample. Third, although we have carefully conducted our textual analysis and manually checked the effectiveness to ensure that the error rate is within the statistically allowable range, textual analysis is always to some degree inexact, particularly when analyzing a large volume of news articles.

Table 7

Mediating role of social media tone in the relationship between BFII and the frequency of VMEFs: BFII measured using MD&A information. This table reports regression results of how BFII influences the probability, frequency, accuracy, and forecast horizon of a VMEF when BFII is measured using news items. The dependent variable is *Forecast_Frequency*. *BFII* equals one (1) if a firm adopts BFII in year *t* and the following years and zero (0) otherwise. *BFII* is measured by MD&A information. The control variables include the logarithm of total assets (*Size*), firm leverage (*LEV*), firm profitability (*ROA*), board size (*Boardsize*), firm cash holdings (*Cash*), firm age (*Listage*), firm property right (*SOE*), ownership concentration (*TOP3*), and industry competition (*Competition*). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1) <i>Dummy_Forecast</i>	(2) <i>Forecast_Frequency</i>
<i>BFII</i>	−0.047 (−1.45)	−0.145 (−0.98)
<i>BFII*Uncertainty</i>	0.086** (2.24)	0.496** (2.17)
<i>Size</i>	−0.007 (−0.44)	−0.131* (−1.85)
<i>Lev</i>	−0.069 (−0.68)	−0.087 (−0.19)
<i>ROA</i>	0.181 (1.40)	0.566 (0.85)
<i>Boardsize</i>	−0.055 (−0.55)	−0.149 (−0.34)
<i>Cash</i>	0.151 (1.19)	0.285 (0.52)
<i>Listage</i>	−0.116*** (−3.89)	−0.676*** (−5.10)
<i>SOE</i>	−0.022 (−0.57)	−0.235 (−1.42)
<i>TOP3</i>	−0.520* (−1.93)	−1.775 (−1.56)
<i>Competition</i>	0.110 (0.85)	0.031 (0.06)
<i>Constant</i>	0.913 (1.46)	6.911*** (2.68)
Year and industry fixed effects	Yes	Yes
Observations	536	536
Pseudo R^2 /Adj. R^2	0.638	0.568

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Appendix 1. Identifying firms adopting BFII based on MD&A information

We follow six steps to obtain the MD&A portion of financial reports. First, we download quarterly, semi-annual, and annual financial reports of A-share listed companies from the Shenzhen and Shanghai Stock Exchange websites. We then import these files into our database system for transcoding and textual analysis. Second, we identify the stock code on the first pages of the financial reports to relate these files to specific listed companies and fiscal years. Third, we identify and then separate all of the pictures and tables, as the financial figures presented in tables become text during the transcoding process. We transform the content of the pictures into text. Tables generally begin with the following words: unit (RMB), unit (shares), serial number, company name, and the table then follows. A table generally ends with “total,” “illustration,” “reason for change,” and words for cross references such as “See note 17 for details” or the title of the next chapter. We separate all of the tables by applying limiting words for the beginning and the ending. Fourth, we remove the formatted content, including the headers, “contents,” “documents for reference,” “e-mail,” and others. Through the above four steps, we obtain a clean database for extracting the MD&A section. Next, we identify the beginning of the MD&A section. We randomly choose 10% of all financial reports and then manually read these files to characterize the beginnings of the MD&A sections. These sections generally start with words like “management discussion and analysis,” “operating discussion and analysis,” “report of the board,” and “executive speech.” We also exclude phrases such as “see management discussion and analysis.” The end of the MD&A section is identified as the title of the next chapter. Last, we randomly choose a sample and check the accuracy of the results of our textual analysis. When the accuracy rate for identifying MD&A sections reaches 98%, it can sufficiently support further analysis.

We use the MD&A sections to determine whether firms adopt BFII in a specific year. BFII is defined as the integration of business and financial information. We identify two sets of words related to this process. The first is a set of verbs, including “starting,” “adopting,” “applying,” “beginning,” and other verbs that suggest starting. The second is a set of words related to BFII, including “business and financial information integration,” “business and financial integration,” “financial sharing,” “integration of business and financial information,” and other Chinese words for BFII. Using textual analysis, we identify whether an MD&A section contains a combination of the two sets of words. For example, if “we have applied business and financial information integration successfully” appears in an MD&A, then we classify the firm as a BFII firm in that year and the following years.

Appendix 2. Identifying firms adopting BFII based on online news and newspapers

MD&A is information released by a firm. As a robustness test, we use external information to identify BFII firms and thus reduce bias in information disclosure. We download all news items containing keywords about business and financial information integration from the HuiKe Database. This database collects articles published by almost 13,000 media sources, including over 1,200 newspapers, 10,000 websites, and 1,500 social media platforms, such as TouTiao, Sino, Sohu, JuChao, and Tencent. The database is updated with newspaper articles every morning between 8 and 10 am, and website news and social media news are updated every second. Items have been collected regularly since 2000, with some items from as far back as 1998. The database holds more than 30,000,000 pieces of news and 500,000 articles. We use keywords to search the database for relevant news items. We search for a set of words related to BFII in Chinese, including “business and financial information integration,” “business and financial integration,” “financial sharing,” “integration of

business and financial information,” and others. We download this news for each year and finally obtain more than 100,000 items of news in .txt format. We import them into our system and begin our textual analysis, following four steps.

First, we relate each piece of news to specific listed companies by identifying those in which their stock code and company name appear together. We also determine the observation year by the date that the news was reported.

Second, we identify whether the firm adopts BFII in a certain year in a manner similar to that used in Appendix 1. We have two sets of words. The first set is verbs, including “starting,” “adopting,” “applying,” “beginning,” and others words with the meaning of starting. The second set is words related to BFII, such as “business and financial information integration,” “business and financial integration,” “financial sharing,” “integration of business and financial information,” and other Chinese words for BFII. Using textual analysis, we identify whether the news contains a combination of the two sets of words. For example, if “we have applied business and financial information integration successfully” appears in a news piece, then the firm is classified as a BFII firm in that year and in the following years.

Third, we use the sub-sample of all BFII firms to conduct further analyses, beginning with a textual analysis process. We establish a dictionary containing 227 words expressing the meaning of uncertainty, such as “it depends on,” “not defined,” “somewhere,” and “seem.”

Last, we count how many uncertainty related words are contained in each piece of news. Then, we divide the number of “uncertainty” words by the number of all of the words in that piece of news. The larger the ratio, the more uncertain social media is about the prospect of a firms’ BFII adoption.

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