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Full Length Article

Do analysts pay attention to managerial sentiment? Evidence from analysts' following decisions and earnings forecasts

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Abstract

We examine the impact of managerial sentiment on analysts' following decisions and earnings forecast accuracy. By analyzing the textual tone of management discussion and analysis sections in annual reports to capture managerial sentiment, we find that when managerial sentiment is more positive, firms attract more analyst following, while analysts' earnings forecasts become more accurate. The findings are robust to firm- and analyst-level forecasts, as well as to alternative metrics of managerial sentiment and analyst earnings forecasts. Additional analysis suggests that the impact is more salient for firms with high-quality information environments and non-star analysts.

Keywords: Managerial sentiment; Textual analysis; Analysts following; Earnings forecast accuracy

1. Introduction

Analysts are essential information intermediaries in financial markets. Among their research outputs, earnings forecasts receive considerable attention from investors. Hence, it is always interesting to examine the determinants of analyst earnings forecast accuracy. Previous studies suggest that analyst characteristics (Stickel, 1992; Clement, 1999; Xu et al., 2013) resource support from brokerages (Jacob et al., 1999; Ree et al., 1999), and external factors contribute to analysts' earnings forecast accuracy. Additionally, exogenous factors such as firms' information disclosure mode (Merkley et al., 2013) also impact analysts' earnings forecast accuracy. A related body of literature examines analysts' decision to follow specific firms. The determinants of such following decisions include the costs and benefits of gathering information (O'Brien & Bhushan, 1990), political risk, judicial efficiency, information disclosure, and effective legal institutions (Boubakri & Bouslimi, 2010), firms' level of earnings management (Hong et al., 2014), analysts' previous professional relationship with a firm's CEO or CFO (Brochet et al., 2014), among other factors.

A parallel body of literature examines managerial sentiment's role in stock market returns (Henry, 2008; Jiang et al., 2019; Myskova & Hajek, 2016; Price et al., 2012; Salhin et al., 2016), information disclosure (Brown et al., 2012; Chen et al., 2021; Hribar et al., 2017), and firm decisions (Antoniou et al., 2017; Hsiao et al., 2014; Montone et al., 2021). However, few studies examine managerial sentiment's role in analysts' following decisions and their earnings forecast accuracy.

This paper aims to examine the impact of managerial sentiment on analyst following and earnings forecast accuracy. Our study is motivated by the fact that corporate textual disclosures are a natural source of managerial sentiment. They are

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officially released by corporate insiders who are more knowledgeable than outsiders (Kearney & Liu, 2014). The linguistic style and tone in these textual disclosures provide more accurate forward-looking information about firms' future performance, compared with quantitative disclosure (Campbell et al., 2020; Davis et al., 2012; Davis & Tama-Sweet, 2012; Li, 2010). Most importantly, textual disclosures in annual reports or management disclosure and analysis sections (MD&As) reflect managers' assessments and beliefs about their firms' prospects (Jiang et al., 2019). We argue that managers are firm insiders and their evaluation of their firms' future is embedded in their sentiment, expressed in annual reports and MD&As. Thus, we can assess managerial sentiment via textual analysis of annual reports and MD&As. We hypothesize that if firms' managerial sentiment is positive, analysts will be more likely to follow them, while the latter's earnings forecasting will be more accurate. The logic is that a positive managerial sentiment reveals valuable information about the firm's future, which is informative to analysts, reduces their research costs, and increases the accuracy of their earnings forecasts, thereby leading to increased analyst following decisions for said firm.

We conduct our analysis by examining managerial sentiment in annual reports and MD&A sections of Chinese firms. The Chinese context is suitable for our study due to its market impediments and young financial industry (Allen et al., 2005; Xu et al., 2013), which makes analysts' role vital in the Chinese financial market. Our findings suggest that, as expected, when management has a more positive sentiment on their firm, it attracts more analyst following, and analyst earnings forecasts become more accurate. The findings are consistent with our testable hypothesis and robust to the firm- and analyst-level forecasts, and alternative metrics of managerial sentiment and analyst earnings forecasts. Additional analysis indicates that the impact is more salient for high-transparency firms or non-star analysts. Overall, managerial tone reflects managerial sentiment; it provides helpful information for analysts' following decisions and improves their earnings forecast accuracy, especially from informationally credible (i.e., transparent) firms or when analysts are less skilled (i.e., non-stars).

This study makes several contributions. First, we advance the literature on managerial sentiment. The major challenge in analyzing the effect of managerial sentiment is the lack of an appropriate metric, which partially explains the slow development of this line of research (Chen et al., 2021). We demonstrate that managerial sentiment, embedded in the tone of annual reports or MD&A sections, is helpful for analysts' following decisions and earnings forecast accuracy. Second, we contribute to the broad literature on analyst research by documenting that managerial sentiment impacts analysts' following decisions and forecast performance. Hence, in addition to exogenous business environment factors and analysts' personal characteristics, managerial sentiment impacts analyst behavior. Third, our results complement the research on managerial tone's role in financial markets. We confirm that the managerial tone embedded in annual reports and MD&A sections is informative and generally helpful to assess managerial sentiment.

2. Literature review and testable hypothesis

2.1. Literature review

2.1.1. Investor and managerial sentiment

The psychology literature argues that emotions affect decision-making and information processing (García, 2013). Leveraging psychological principles, behavioral finance researchers examine the impact of market participants' emotions in capital markets. A large body of behavioral finance literature documents investor sentiment's effect on stock market returns (Baker & Wurgler, 2006, 2007; Huang et al., 2015; Stambaugh et al., 2012; Yu & Yu, 2011), suggesting that investor sentiment is predictive of stock returns.

Additionally, several studies report that investor sentiment is a determinant of corporate investments (Arif & Lee, 2014; McLean & Zhao, 2014) and institutional investors' decision to invest in the firm (Cornell et al., 2014). Investor sentiment also plays a role in corporate disclosure decisions. Specifically, when investor sentiment is high, firms generally reduce the frequency of long-term forecasts (Bergman & Roychowdhury, 2008), are more likely to make pro forma earnings disclosure (Brown et al., 2012) or qualitative disclosure (Bochkay & Dimitrov, 2015).

Furthermore, a few studies investigate investor sentiment's impact on analysts. Essentially, when investor sentiment is high, analysts make more optimistic earnings forecasts for their followed firms (Wu et al., 2018), especially those with high uncertainty (Hribar & McInnis, 2012; Walther & Willis, 2013).

Unlike investors, managers are insiders with a good understanding of their firms' operations. Accordingly, managers possess private information that is useful for market participants. The literature on managerial sentiment has three strands. The first strand is related to market reaction. Henry (2008) finds that positive managerial sentiment brings a positive abnormal stock price reaction to earnings announcements. Moreover, Salhin et al. (2016) show that managerial sentiment is predictive to aggregate and sector stock returns. Similarly, Price et al. (2012) suggest that the positive managerial sentiment from the managerial tone of conference calls is a significant determinant of abnormal stock price reaction and trading volume.

In the second strand, several studies report that managerial sentiment is as important as investor sentiment, if not more so. For instance, Brown et al. (2012) find managerial sentiment to be useful in predicting firms' expected returns after accounting for investor sentiment. Jiang et al. (2019) document that managerial sentiment is more powerful in predicting stock returns, compared with investor sentiment.

The third strand is related to corporate decision-making. Hsiao et al. (2014) show that when managerial sentiment is high (low), a firm is more likely to overinvest (underinvest). Further, Antoniou et al. (2017) report that when managerial sentiment is low, firms hold less cash, make fewer R&D investments, and use lower financial leverage, suggesting that managerial sentiment plays a role in firms' general operating strategy. Moreover, a positive managerial sentiment influences

other stakeholders in trade credit (Jochem & Peters, 2018) or employing labor (Montone et al., 2021).

2.1.2. Analyst behavior

Because there is a large body of literature on analyst behavior, we only highlight some studies below, focusing on analysts' earnings forecast accuracy and their following decisions.

2.1.2.1. Analyst earnings forecast accuracy. There are two major strands of literature in this regard. The first strand focuses on how analysts' personal characteristics affect their earnings forecast accuracy. Clement (1999) conducts a comprehensive analysis of the effect of analysts' characteristics on earnings forecast accuracy. He concludes that analysts' ability, task difficulty, and resources at their brokerages are the key contributing factors.

For analysts' ability, studies suggest that analysts' experience is positively correlated with forecast accuracy (Jacob et al., 1999; Mikhail et al., 1997). The findings imply that analysts improve their forecasting ability through their sell-side research experience. An alternative way to gauge analyst ability is to use a peer-reviewed system. If an analyst obtains "star" status in their profession (Stickel, 1992; Xu et al., 2013), they have superior skills. In terms of task difficulty, Clement (1999) finds that if an analyst follows more firms or industries, the forecast accuracy decreases, presumably due to heavy working loads. Last, a brokerage's resource also contributes to analyst forecast accuracy. The literature generally documents that analysts from large brokerages provide more accurate forecasts, compared with those from small brokerages (Clement, 1999; Jacob et al., 1999; Ree et al., 1999).

The second strand of literature focuses on the external factors (i.e., those beyond analyst characteristics) that impact analysts' earnings forecast accuracy. These factors include firms' information disclosure mode (Merkley et al., 2013), the quantity of information disclosure (Parkash et al., 1995), firm complexity (Lehavy et al., 2011), high market uncertainty (Amiram et al., 2018), increased political uncertainty (Yu et al., 2020), and increased convenience to make corporate site visits due to improvements in transportation (Kong et al., 2020).

2.1.2.2. Analysts' following decisions. O'Brien and Bhushan (1990) provide a pioneer study on analysts' following decisions. They posit that the costs and benefits of gathering information are crucial for analysts' following decisions. The authors document that following decisions depend on firm and industry characteristics, suggesting that firms that share more common characteristics (e.g., being in the same industry) are more likely to be followed by analysts, as they are more cost-effective to follow. In contrast, analysts avoid volatile firms and those being followed by many analysts, as following them involves higher costs or lower benefits. Additionally, using a simultaneous equation system, Hong et al. (2014) document that when firms' earnings management is high, their research costs increase, leading to reduced analyst following.

Other studies identify the specific factors contributing to analysts' following decisions, including political risk, judicial efficiency, information disclosure, effective legal institutions of newly privatized firms (Boubakri & Bouslimi, 2010), previous professional relationship with a firm's CEO or CFO (Brochet et al., 2014), among others.

Currently, the focus of analysts' following decisions often steers toward corporate transparency. When a firm has high corporate transparency, it attracts more investors in capital markets. Moreover, when the demand for firm research increases, analyst following increases as well (Brammer & Millington, 2005). Additionally, when a firm provides more information to the market, investors can use more information, which leads to increased analyst following (Lang & Lundholm, 1998; Lehavy et al., 2011; Nichols & Wieland, 2009).

Further, various studies suggest that analysts have optimism bias in their earnings forecasts (Francis & Philbrick, 1993; Ke & Yu, 2006; Richardson et al., 2004). Additionally, some brokerages with a prior relationship with a firm may pressure analysts to provide optimistically biased forecasts (Chan et al., 2020; Firth et al., 2013; Gu et al., 2013). If a firm has positive managerial sentiment, it is easier for a brokerage to urge analysts to follow said firm.

2.2. Testable hypotheses

Our literature review shows that managerial sentiment is a valuable source of information. A positive managerial sentiment suggests the firm's future is positive, thereby attracting investors' interest. Moreover, since managerial optimism increases the expectation of future performance, which increases management willingness to release more information (Libby & Rennekamp, 2012), a positive managerial sentiment suggests that the firm is more transparent. The expression of positive managerial sentiment has three main effects.

First, increased investor interest in the firm means the demand for firm analyst research increases. Analyst following can bring revenue to brokerages. Consequently, we expect there will be an increase in analyst following after positive managerial sentiment is revealed in annual reports.

Second, firms' increased information disclosure may make analysts' task easier by providing them with useful information, which implicitly lowers the cost their services (Bhushan, 1989). Therefore, when a firm is more transparent, analysts can take on a heavier workload.

Third, brokerages have good reasons (e.g., revenue consideration) to pressure their analysts into following certain firms due to their positive managerial sentiment. Consequently, said firms' analyst following increases. Hence, the first hypothesis is:

H1. *When managerial sentiment is positive, analyst following increases*

We propose three arguments regarding managerial sentiment's impact on analyst earnings forecast accuracy. First, for analyst earnings forecasts, a positive managerial sentiment suggests that a firm's management is confident about its future. Libby and Rennekamp (2012) and Hribar and Yang (2016) show that optimistic sentiment indicates that managers are confident in their firms' future. This leads managers to increase their willingness to commit to performance by issuing voluntary earnings forecasts. Similarly, Alqatamin et al. (2017) suggest that confident managers are more willing to disclose forward-looking information. Since managers use voluntary disclosure to signal private information to the market (Beyer et al., 2010; Watts & Zimmerman, 1978), analysts (who are sophisticated individuals in the capital market) respond strongly to these signals, as they are more informative about future earnings changes, and use this knowledge to provide more accurate forecasts, relative to other market participants.

Second, analysts prefer not to follow firms with uncertainty. Additionally, analysts can extract information from the publicly observable actions of other analysts (Clement et al., 2011). Intuitively, as more analyst opinions are added, idiosyncratic noise gets averaged out. Alford and Berger (1999) argue that analyst following measures the amount of information privately gathered about a firm. Thus, increased analyst following caused by optimistic managerial sentiment indicates that greater private acquisition of information is associated with increased certainty regarding the firm's prospects and, correspondingly, more accurate earnings forecasts made by analysts.

Third, positive managerial sentiment suggests that firms' outlook is positive (Bochkay & Levine, 2019; Feldman et al., 2010; Li, 2010). These firms draw attention from investors, thereby leading to increased analyst following (as expected in H1). Due to the visibility of the followed firms, to uphold their professional reputation, analysts extensively research these firms, thereby leading to more accurate forecasts.

Overall, we expect analysts to enhance their earnings forecast accuracy with more positive managerial sentiment information. Additionally, if the information in positive managerial sentiment is misleading, it may lead to lawsuits from investors and other stakeholders. Hence, a positive managerial sentiment, although possibly too optimistic, is generally credible (Benabou & Laroque, 1992; Healy et al., 1999). Thus, analysts can leverage the credible information embedded in firms' positive managerial sentiment to improve their forecasts' quality. Consequently, analyst earnings forecasts become more accurate.

We state the second hypothesis as:

H2. *When managerial sentiment is positive, analyst earnings forecasts become more accurate*

3. Research design

3.1. Data

We use data from all Chinese A- share listed firms for the period 2008–2019 as our initial sample. Subsequently, we delete financial firms, financially distressed firms, and firms with missing accounting information. The final sample comprises 19,752 firm-years. To account for firm-level analyst earnings forecast error, we reduce the sample to 15,411 firm-years, as some firms lack analyst coverage. At the analyst level, we have 231,767 analyst-firm-years. The data are from the China Stock Market and Accounting Research database. Internal control data are obtained from the DIB Inc. We winsorize all data at the 1% and 99% levels.

To assess managerial sentiment, we analyze the tone of management. Specifically, we follow the methodology established by Loughran and McDonald (2011). First, we download the.pdf files of firms' annual reports from the Chinese Research Data Services. Second, we adapt the positive- and negative-toned keywords dictionary from Loughran and McDonald (2011), using the Chinese translation. Third, we use Python software to read the.pdf files to count the number of times the keywords (those in Appendix A or alike) appeared. A sample of statements in firms' MD&A section is presented in Appendix B. There are a total 1076 positive and 2080 negative keywords from the MD&A sections. Last, we define managerial sentiment as: $MS = (POS - NEG)/(POS + NEG)$; where POS = the total appearance of positive tone keywords and NEG = total appearance of negative tone keywords.

3.2. Multiple regression model

We use Eq. (1) below to examine the impact of managerial sentiment at *t-1* for the analyst following at *t*:

$$FOLLOW_{i,t}(or\ ANALYST_{i,t}) = \alpha_0 + \alpha_1 MS_{i,t-1} + Controls_{i,t} + Year + Industry + \varepsilon_{i,t} \quad (1)$$

where *FOLLOW* is a (1, 0) indicator variable with a value of 1 if a firm has analyst following and 0 otherwise; *ANALYST* is the natural logarithm of 1 plus the total number of analysts following the firm, and *MS* is the managerial sentiment. We use two metrics for *MS* for robustness: the tone from the annual report (*AR_MS*) and that from the MD&A sections of the annual report (*MDA_MS*). A large value of *AR_MS* or *MDA_MS* suggests that a firm's management has positive sentiment about its future. We use Probit (Tobit) to estimate Eq. (1) when we use *FOLLOW* (*ANALYST*) as the dependent variable. Using *FOLLOW* (*ANALYST*) at *t* and managerial sentiment at *t-1* can mitigate the simultaneous decisions between analysts' following decisions and managerial decisions (such as earnings management decisions in Hong et al., 2014).

To calculate analyst earnings forecast accuracy, we follow Clement's (1999) and Hope (2003) research in the following model:

$$FERR_{i,t}(or\ ERROR_{j,i,t}) = \beta_0 + \beta_1 MS_{i,t-1} + Controls_{i,t} + Year + Industry + \varepsilon_{i,t} \quad (2)$$

where *FERR* (*ERROR*) is the firm-level (analyst-level) earnings forecast error, which is the ratio of the absolute value of the difference between actual earnings per share and a firm's (an

Table 1
Variable definitions.

Variable	Definitions
FOLLOW	If a firm has analyst following, the value is 1 and 0 otherwise
ANALYST	The natural logarithm of 1 plus the total number of analysts following a firm
FERR	Firm level analyst earnings forecast error using Eq. (2)
ERROR	Analyst level earnings forecast error using Eq. (3)
AR_MS	Managerial sentiment from textual analysis on an annual report using Eq. (1)
MDA_MS	Managerial sentiment from textual analysis on the management discussion and analysis sections of an annual report using Eq. (1)
SIZE	The natural logarithm of a firm's total assets
SOE	If a firm is state-owned, the value is 1 and 0 otherwise
TOP1	The percentage ownership of top-one shareholder
ROA	The ratio of net income to total assets
LEV	The ratio of total liabilities to total assets
MTB	The ratio of total assets to market value
EV	The standard deviation of net income in previous three years
LOSS	If a firm has operating loss, the value is 1 and 0 otherwise
DECL	If a firm's earnings per share is less than previous year, the value is 1 and 0 otherwise
DIB	The natural logarithm value of the internal control index by DIB
EQ	We follow Dechow and Dichev (2002) to estimate the following equation within an industry and a year and use the absolute value of the residual from as the earings quality metric (*EQ*): $\Delta WC_{i,t} = \alpha_0 + \alpha_1 CFO_{i,t-1} + \alpha_2 CFO_{i,t} + \alpha_3 CFO_{i,t+1} + \varepsilon_{i,t}$ Where $\Delta WC_{i,t}$ is the change of working capital and CFO is cashflow from operation
BIG4	If a firm has a big-four auditor, the value is 1 and 0 otherwise
AGE	The number of years listing
EXP	The natural logarithm of 1 plus the number of quarters an analyst making earnings forecasts
EXP^2	Squared of *EXP*
STAR	If an analyst is a star analyst, the value is 1 and 0 otherwise

Table 1 presents the definitions of major variables.

analyst's) forecasted earnings per share to the absolute value of the actual earnings per share. A high value of *FERR* or *ERROR* indicates inaccurate analyst earnings forecasts.

The robust standard errors of estimates in Eqs. (1) and (2) are clustered at the firm level. In Eq. (1), the set of control variables includes firm size (*SIZE*), state-ownership (*SOE*), the largest shareholders' ownership (*TOP1*), return on assets (*ROA*), financial leverage (*LEV*), market-to-book ratio (*MTB*), earnings variation (*EV*), whether a firm has operating loss (*LOSS*), earnings per share change (*DECL*), internal control quality (*DIB*), corporate transparency (*EQ*), auditor quality (*BIG4*), and firm age (*AGE*). In Eq. (2), we use the same control variables as in Eq. (1), while adding analyst-level variables such as analyst experience (*EXP*), squared of analyst experience (EXP^2), and whether they are a star analyst (*STAR*). We account for year- and industry-fixed effects in both equations. The detailed definitions of all variables are presented in Table 1.

4. Results and discussions

4.1. Summary statistics

We present the summary statistics of the sample in Table 2. The mean of *FOLLOW* is 0.773, suggesting that 77.3% of the firms have analyst following. For *ANALYST,* the mean is 1.571, indicating that, on average, firms are followed by 3.8 analysts (before the natural logarithm). The mean and standard deviation of *FERR* are 0.953 and 2.069, respectively. Hence, analysts have a considerable margin of error in their earnings forecasts, and there is significant variation across analysts. In terms of managerial sentiment in annual reports, the mean and standard deviation of *AR_MS* are 0.022 and 0.070, respectively. From an annual report perspective, the positive sentiment (net positive tone) is low, but the variation is high. In contrast, the mean and standard deviation of *MDA_MS* are 0.443 and 0.138, respectively, indicating that the positive sentiment in the MD&A sections is high with low variation, which is consistent with Hackbarth's (2008) research. Given that *AR_MS* and *MDA_MS* are different, including both metrics for robustness is imperative.

4.2. Baseline results

We present the firm-level results for Eqs. (1) and (2) in columns (1)−(6) in Table 3. The coefficients of AR_MS_{t-1} and MDA_MS_{t-1} are positive and significant at the 1% level in columns (1)−(4) and are negative and significant at the 1% or 5% level in columns (5)−(6). Hence, when managerial sentiment is positive, the firm attracts increased analyst following, while analyst earnings forecasts are more accurate. In Table 4, we present the analyst-level findings. In both columns, the coefficients of AR_MS_{t-1} and MDA_MS_{t-1} are negative and significant at the 1% level.

The findings in Tables 3 and 4 support H1 and H2 and are economically significant. Column (4) in Table 3 shows that the coefficient of AR_MS_{t-1} is 2.298. Hence, one standard deviation increase in *AR_MS* (0.070) translates into 0.161 more analyst following, representing approximately 10.00% (0.161/1.609)

Table 2
Summary statistics.

Variable	N	Mean	Std	Min	p25	p50	p75	Max
FOLLOW	19,752	0.773	0.419	0	1	1	1	1
ANALYST	19,752	1.571	1.154	0	0.693	1.609	2.565	3.761
FERR	15,411	0.953	2.069	0.00200	0.100	0.291	0.833	14.33
ERROR	231,767	0.635	1.353	0	0.0680	0.190	0.577	9.668
EXP	231,767	2.259	0.784	0.571	1.690	2.268	2.885	3.832
STAR	231,767	0.0700	0.255	0	0	0	0	1
MDA_MS	19,752	0.443	0.138	0.0640	0.357	0.447	0.534	0.776
AR_MS	19,752	0.0220	0.0700	−0.137	−0.0260	0.0220	0.0690	0.194
SIZE	19,752	22.13	1.281	19.75	21.20	21.95	22.86	26.08
SOE	19,752	0.433	0.496	0	0	0	1	1
TOP1	19,752	35.30	15.29	3.296	23.39	33.75	45.86	75.10
ROA	19,752	0.0440	0.0540	−0.152	0.0160	0.0390	0.0700	0.213
LEV	19,752	0.437	0.207	0.0510	0.272	0.434	0.597	0.882
MTB	19,752	0.616	0.242	0.124	0.427	0.617	0.805	1.117
EV	19,752	1.187	3.051	0.0260	0.190	0.367	0.816	23.95
LOSS	19,752	0.0710	0.256	0	0	0	0	1
DECL	19,752	0.509	0.500	0	0	1	1	1
DIB	19,752	6.351	0.972	0	6.441	6.516	6.564	6.803
EQ	19,752	0.105	0.0950	0.00100	0.0350	0.0780	0.146	0.454
BIG4	19,752	0.0550	0.227	0	0	0	0	1
AGE	19,752	9.871	6.592	1	4	9	15	28

Table 2 presents the summary statistics of the sample. Variable definitions are presented in Table 1.

more analysts following a median firm. Similarly, the coefficient of AR_MS_{t-1} in column (6) of Table 3 is −0.768. One standard deviation increase in *AR_MS* improves an analyst's firm-level earnings forecast accuracy by 0.054, approximately 18.56% better than a median firm (0.054/0.291).

In both Tables 3 and 4, the coefficients of control variables, if significant, carry the expected signs. For instance, the coefficients of *SIZE, ROA,* and *DECL* are consistently positive and significant at the 1% or 5% level in columns (1)–(4) in Table 3. These results suggest that when a firm is large, profitable, or has experienced a decline in earnings, it attracts analysts' attention. In terms of earnings forecast accuracy in Tables 3 and 4, the coefficients of *SIZE, SOE, ROA,* and *MTB* are negatively significant, indicating analysts generally have fewer errors when a firm is large, state-owned, profitable, or has high market-to-book value.

4.3. Robustness checks

We conduct several robustness checks and present the findings in Table 5. For brevity, we do not present the coefficients of control variables hereafter. First, instead of the annual report or MD&A, we examine the impact of managerial sentiment from a firm's earnings public release statement and denote the related variable as *PR_MS*. Then, we replace AR_MS_{t-1} and MDA_MS_{t-1} with PR_MS_{t-1} in Eq. (1). The coefficients of PR_MS_{t-1} continue to be significant at the 1%, 1%, 5%, or 1% level in columns (1) to (4), respectively, in Panel A of Table 5.

Second, we follow Jiang et al. (2019) and use a weighted average metric of managerial sentiment in annual reports (MD&A) and earnings public release statements. Specifically, we construct *w_MS1 = 0.5*AR_MS + 0.5*PR_MS* and *w_MS2 = 0.5*MDA_MS + 0.5*PR_MS*. Then, we use *w_MS1* and *w_MS2* to replace *AR_MS* and *MDA_MS* in Eq. (1). We present the results in Panel B of Table 5. The coefficients of *w_MS1* and *w_MS2* remain significant—with the corrected signs—in predicting analysts' following decisions and forecast accuracy.

Third, instead of *FERR*, we use the average accuracy of all analysts' most recent forecasts (denoted as *FERR2*). Similarly, instead of *ERROR*, we use the average accuracy of each analyst's forecast in each year (denoted as *ERROR2*). Then, we use *FERR2* and *ERROR2* as the dependent variables in Eq. (1). The coefficients of AR_MS_{t-1} and MDA_MS_{t-1} remain negative and significant at the 1% level in all columns in Panel C of Table 5. Overall, the results in Table 5 suggest that our baseline findings in Tables 3 and 4 are robust.

4.4. Additional analysis

4.4.1. Abnormal managerial sentiment

We conduct an additional analysis that is based on abnormal managerial sentiment (*MS_AB*). Essentially, *MS_AB* is the managerial sentiment that goes beyond the normal forecast level. The use of *MS_AB* is to mitigate the possibility that some firm management persistently positive or negative in their tone. Hribar et al. (2017) define managerial sentiment as mangers' beliefs about future firm outcomes that are not justified by the information available to them, they use the residual from the regression that controls for firm fundamentals as a measure of sentiment. Specifically, we follow Huang et al. (2014) to use Eq. (3) below to estimate a normal level of *MS*. The residual represents *MS_AB* (both MD&A and annual report metric: *MDA_MS_AB* and *AR_MS_AB*).

Table 3
The impact of managerial sentiment on analyst following and earnings forecast: Firm-level analysis.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	$FOLLOW_t$	$FOLLOW_t$	$ANALYST_t$	$ANALYST_t$	$FERR_t$	$FERR_t$
MDA_MS_{t-1}	1.172***		1.118***		−0.350**	
	(0.120)		(0.093)		(0.149)	
AR_MS_{t-1}		2.425***		2.298***		−0.768***
		(0.280)		(0.205)		(0.271)
$SIZE_t$	0.838***	0.857***	0.786***	0.799***	−0.063***	−0.067***
	(0.031)	(0.032)	(0.018)	(0.018)	(0.023)	(0.023)
SOE_t	−0.124***	−0.092**	−0.176***	−0.143***	−0.112**	−0.124***
	(0.046)	(0.046)	(0.037)	(0.037)	(0.045)	(0.046)
$TOP1_t$	−0.003**	−0.003**	−0.005***	−0.005***	−0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ROA_t	5.378***	5.552***	6.957***	7.129***	−10.196***	−10.252***
	(0.335)	(0.338)	(0.271)	(0.273)	(0.468)	(0.466)
LEV_t	−0.513***	−0.438***	−0.336***	−0.253***	0.062	0.034
	(0.110)	(0.110)	(0.090)	(0.090)	(0.136)	(0.137)
MTB_t	−1.527***	−1.591***	−1.525***	−1.573***	−0.450***	−0.435***
	(0.112)	(0.113)	(0.077)	(0.077)	(0.111)	(0.112)
EV_t	−0.002	−0.003	−0.003	−0.004	0.003	0.003
	(0.004)	(0.004)	(0.003)	(0.003)	(0.006)	(0.006)
$LOSS_t$	−0.319***	−0.376***	−0.359***	−0.415***	0.598***	0.615***
	(0.046)	(0.046)	(0.039)	(0.038)	(0.118)	(0.118)
$DECL_t$	0.053**	0.054**	0.066***	0.065***	0.840***	0.841***
	(0.026)	(0.026)	(0.016)	(0.016)	(0.027)	(0.027)
DIB_t	0.014	0.014	0.017	0.019*	−0.063*	−0.063*
	(0.013)	(0.013)	(0.011)	(0.011)	(0.036)	(0.036)
EQ_t	0.030	0.061	0.118	0.164	0.092	0.072
	(0.167)	(0.168)	(0.122)	(0.124)	(0.178)	(0.179)
$BIG4_t$	0.056	0.025	−0.165***	−0.232***	0.014	0.037
	(0.113)	(0.117)	(0.060)	(0.062)	(0.064)	(0.065)
AGE_t	−0.051***	−0.048***	−0.044***	−0.041***	0.006*	0.005
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
YEAR	yes	yes	yes	yes	yes	yes
INDUSTRY	yes	yes	yes	yes	yes	yes
Constant	−16.050***	−16.067***	−14.576***	−14.521***	4.095***	4.083***
	(0.598)	(0.610)	(0.365)	(0.364)	(0.508)	(0.508)
N	19,752	19,752	19,752	19,752	15,411	15,411
Pseudo R^2	0.278	0.278	0.199	0.199		
Adj. R^2					0.150	0.150

Table 3 presents the results for the impact of managerial sentiment on analyst following and earnings forecast at firm-level. We estimate columns (1) to (2) by probit, columns (3) to (4) by Tobit, and columns (5) and (6) by ordinary least squares. Variable definitions are presented in Table 1. ***, **, and * indicate 1%, 5%, and 10% significant, respectively.

$$MS_{i,t}=\alpha_0+\alpha_1 EARN_{i,t}+\alpha_2 RET_{i,t}+\alpha_3 MV_{i,t}+\alpha_4 MTB_{i,t}+\alpha_5 STDRET_{i,t}+\alpha_6 STDEARN_{i,t}+\alpha_7 AGE_{i,t}+\alpha_8 BUSSEG_{i,t}+\alpha_9 GEOSEG_{i,t}+\varepsilon_{i,t} \quad (3)$$

where *MS* is managerial sentiment; *EARN* is the earnings before extraordinary income scaled by beginning total assets; *RET* is the contemporaneous annual stock returns; *MV* is the logarithm of market value of equity at the fiscal year-end; *MTB* is the ratio of total assets to market value; *STDRET* is the standard deviation of monthly stock return over one fiscal year; *STDEARN* is the standard deviation of *EARN* over the previous five years; *AGE* is the number of years listing; *BUSSEG* is the logarithm of 1 plus the number of business segment; *GEOSEG* is the logarithm of 1 plus the number of geographic segment.

We then use *MDA_MS_AB* and *AR_MS_AB* to replace the *MDA_MS* and *AR_MS* metric in the Eq. (1). The results in Panels A and B of Table 6 show that the coefficients of *MDA_MS_AB* and *AR_MS_AB* continue to be significant at the 1% level with the expected signs. The results corroborate with the baseline results.

4.4.2. Use fixed effects to mitigate endogeneity

We include various fixed effect to mitigate potential endogeneity issues due to missing variables. In Table 7, we account for year*industry and year*province fixed effects. These additional fixed effects also account for the fact that analysts or firms may change their forecasts or sentiment due to year, industry, or province. The results from Panels A to D of Table 7 show that the results are consistent with the baseline findings.

Table 4
The impact of managerial sentiment on analyst earnings forecast: Analyst-level analysis.

Variables	(1)	(2)
	$ERROR_t$	$ERROR_t$
MDA_MS_{t-1}	−0.430***	
	(0.103)	
AR_MS_{t-1}		−0.500***
		(0.191)
$SIZE_t$	−0.035**	−0.039**
	(0.017)	(0.018)
SOE_t	−0.054*	−0.062*
	(0.032)	(0.033)
$TOP1_t$	0.001	0.001
	(0.001)	(0.001)
ROA_t	−7.700***	−7.774***
	(0.412)	(0.413)
LEV_t	0.044	0.022
	(0.100)	(0.100)
MTB_t	−0.314***	−0.295***
	(0.089)	(0.090)
EV_t	0.034***	0.034***
	(0.008)	(0.008)
$LOSS_t$	0.228**	0.260***
	(0.094)	(0.095)
$DECL_t$	0.628***	0.626***
	(0.020)	(0.020)
DIB_t	−0.075**	−0.076***
	(0.029)	(0.029)
EQ_t	−0.077	−0.100
	(0.120)	(0.122)
$BIG4_t$	−0.003	0.009
	(0.048)	(0.048)
AGE_t	−0.001	−0.001
	(0.002)	(0.002)
EXP_t	0.513***	0.512***
	(0.025)	(0.025)
$EXP_t^{\wedge 2}$	−0.100***	−0.100***
	(0.005)	(0.005)
$STAR_t$	−0.031*	−0.031*
	(0.017)	(0.017)
YEAR	yes	yes
INDUSTRY	yes	yes
Constant	2.658***	2.581***
	(0.385)	(0.393)
N	231,767	231,767
Adj. R^2	0.200	0.199

Table 4 presents the results for the impact of managerial sentiment on earnings forecast at analyst-level. We estimate columns (1) and (2) by Tobit. Variable definitions are presented in Table 1. ***, **, and * indicate 1%, 5%, and 10% significant, respectively.

4.4.3. Industry-adjusted managerial sentiment

It is possible that year and industry may have specific influence on managerial sentiment. To mitigate the concern, we use industry-adjusted managerial sentiment metric. We use each firm's metric minus its industry average to mitigate the industry effect. The results in Table 8 are similar to the baseline results.

4.4.4. The moderating effect of a firm's information environment

Analysts' effectiveness depends, partially, on the followed firm's complexity. We expect that the revealed managerial sentiment will be credible if a firm has a high-quality information environment. Thus, the effect of managerial sentiment is more salient for high-quality information environment firms. We use two methods to gauge firms' information environment.

First, based on the median value of earnings quality (*EQ*), we partition the full sample into high- and low-quality information environment firms and reexamine Eq. (1). Precisely, we follow Dechow and Dichev (2002) to estimate the following equation within an industry and a year and use the absolute value of the residual from as *EQ*:

$$\Delta WC_{i,t} = \alpha_0 + \alpha_1 CFO_{i,t-1} + \alpha_2 CFO_{i,t} + \alpha_3 CFO_{i,t+1} + \varepsilon_{i,t} \quad (4)$$

where $\Delta WC_{i,t}$ is the change of working capital and *CFO* is cashflow from the operation.

We present the findings in Panels A and B of Table 9. The coefficients of AR_MS_{t-1} and MDA_MS_{t-1} remain significant with the expected signs in columns (1)−(6) in both Panels. However, the magnitude of coefficients (in absolute value) in the high-quality information environment subsample are larger than those of low-quality information environment subsamples in almost all columns in both panels. In terms of statistical significance, the differences of coefficients of AR_MS_{t-1} and MDA_MS_{t-1} across columns (1)/(2) and (3)/(4) are significant at the 1% or 5% level in both Panels. In columns (5)−(6) of both panels, the coefficients of AR_MS_{t-1} and MDA_MS_{t-1} are only significant in the high-quality information environment subsample, and the difference of the coefficients of MDA_MS_{t-1} across columns (5) and (6) is significant at the 10% level.

Second, we use firms' ROA_{t+1} to partition the full sample into subsamples of high- and low-quality information environments. If a firm's future *ROA* (i.e., ROA_{t+1}) is high and has a positive sentiment at *t*, the positive sentiment is credible. Accordingly, we expect the effect of managerial sentiment on analyst following and forecast accuracy will be more salient. We present the findings in Panels A and B of Table 10. The results are qualitatively similar to those of Table 9.

We interpret the findings in Tables 9 and 10 to be consistent with our conjecture that when a firm has a high-quality information environment, its managerial sentiment is credible. Therefore, analyst following and forecast accuracy are stronger when a firm has a high-quality information environment.

4.4.5. The moderating effect of analyst ability

Analysts are not homogenous. Some analysts (i.e., star analysts) are better than others (Xu et al., 2013). McEwen and Hunton (1999) document that star analysts have superior ability and many ways to gauge a firm's quality, compared with non-star analysts. Thus, star analysts do not heavily rely on information embedded in annual reports or their MD&A sections.

We conjecture that these star analysts pay less attention to managerial sentiment, compared with non-star analysts, because of their own (reliable) methods to conduct research. As the proportion of star analysts is relatively small in our full sample, in order to control for the potential sample selection bias, we apply the propensity score matching (PSM) method to

Table 5
Robustness checks.

Panel A: Using performance briefing to gauge managerial sentiment

Variables	(1)	(2)	(3)	(4)
	$FOLLOW_t$	$ANALYST_t$	$FERR_t$	$ERROR_t$
PR_MS_{t-1}	0.908***	0.637***	−0.425**	−0.277***
	(0.154)	(0.105)	(0.173)	(0.033)
Control var.	Yes	Yes	Yes	Yes
YEAR	yes	yes	yes	yes
INDUSTRY	yes	yes	yes	yes
Constant	−17.019***	−14.022***	3.823***	2.320***
	(1.233)	(0.687)	(0.938)	(0.184)
Observations	7731	7731	6512	101,077
Pseudo R^2	0.262	0.178		
Adj. R^2			0.177	0.208

Panel B: Using weighted measure of managerial sentiment

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$FOLLOW_t$	$FOLLOW_t$	$ANALYST_t$	$ANALYST_t$	$FERR_t$	$FERR_t$	$ERROR_t$	$ERROR_t$
w_MS1_{t-1}	1.938***		1.459***		−0.402*		−0.345***	
	(0.228)		(0.151)		(0.230)		(0.043)	
w_MS2_{t-1}		2.284***		1.747***		−0.813***		−0.483***
		(0.281)		(0.193)		(0.308)		(0.059)
Control var.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YEAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
INDUSTRY	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−17.188***	−17.273***	−14.175***	−14.213***	3.799***	3.900***	2.337***	2.365***
	(1.227)	(1.245)	(0.680)	(0.685)	(0.940)	(0.944)	(0.184)	(0.185)
Observations	7731	7731	7731	7731	6512	6512	101,077	101,077
Pseudo R^2	0.269	0.268	0.183	0.182				
Adj. R^2					0.177	0.177	0.208	0.208

Panel C: Using alternative metrics of analyst earnings forecasts

Variables	(1)	(2)	(3)	(4)
	$FERR2_t$	$FERR2_t$	$ERROR2_t$	$ERROR2_t$
AR_MS_{t-1}	−0.350***		−0.510***	
	(0.136)		(0.116)	
MDA_MS_{t-1}		−0.746***		−0.635***
		(0.251)		(0.214)
Control var.	Yes	Yes	Yes	Yes
YEAR	yes	yes	Yes	Yes
INDUSTRY	yes	yes	Yes	Yes
Constant	4.127***	4.114***	2.834***	2.741***
	(0.462)	(0.462)	(0.420)	(0.428)
Observations	15, 411	15, 411	115,951	115,951
Adj. R^2	0.147	0.147	0.196	0.195

Panels A to C of Table 5 present the robustness results for the impact of managerial sentiment on analyst following and earnings forecast. Panel A uses managerial sentiment metrics from a firm's performance briefing. Panel B uses a weighted metric of managerial sentiment. $w\_MS1 = 0.5*AR\_MS + 0.5*PR\_MS$ and $w\_MS2 = 0.5*MDA\_MS + 0.5*PR\_MS$. Panel C uses alternative metrics of analyst earnings accuracy. *FERR2* is the average accuracy of all analysts' most recent forecasts and *ERROR2* is the average accuracy of each analyst's forecast in each year. We do not present the coefficients of control variables for brevity. Variable definitions are presented in Table 1. ***, **, and * indicate 1%, 5%, and 10% significant, respectively.

obtain the star analyst subsample (16,179) and a matched non-star analyst subsample (16,213). Then, we use the PSM samples to reexamine Eq. (1). The results are presented in Table 11. The coefficients of AR_MS_{t-1} and MDA_MS_{t-1} are negative and significant at the 1% or 5% level in the non-star subsample in columns (2) and (4). In contrast, the same coefficients are insignificant in the star subsample in columns (1) and (3). The differences of the coefficients of MDA_MS_{t-1} across columns (1) and (2) are significant at the 1% level. Managerial sentiment's impact on analyst following and earnings forecast accuracy is more pronounced among non-star analysts.

5. Conclusion

We study managerial sentiment's impact on analyst behavior in a sample of Chinese firms. Precisely, we document that when managerial sentiment is positive in a firm's annual reports

Table 6
Abnormal managerial sentiment.

Panel A: The impact of abnormal managerial sentiment on analyst following and earnings forecasts (firm level)						
	(1)	(2)	(3)	(4)	(5)	(6)
	$FOLLOW_t$	$FOLLOW_t$	$ANALYST_t$	$ANALYST_t$	$FERR_t$	$FERR_t$
$MDA\_MS\_AB_{t-1}$	1.063***		1.040***		−0.274*	
	(0.141)		(0.107)		(0.166)	
$AR\_MS\_AB_{t-1}$		2.181***		2.236***		−0.612**
		(0.324)		(0.234)		(0.300)
Control var	Yes	Yes	Yes	Yes	Yes	Yes
YEAR	Yes	Yes	Yes	Yes	Yes	Yes
INDUSTRY	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−15.993***	−16.301***	−14.076***	−14.353***	3.817***	3.904***
	(0.696)	(0.704)	(0.423)	(0.415)	(0.527)	(0.528)
N	14, 547	14, 547	14, 547	14, 547	11, 285	11, 285
Pseudo R^2	0.287	0.287	0.207	0.208		
Adj. R^2					0.146	0.146

Panel B: The impact of abnormal managerial sentiment on earnings forecasts (analyst level)		
	(1)	(2)
	$ERROR_t$	$ERROR_t$
$MDA\_MS\_AB_{t-1}$	−0.375***	
	(0.123)	
$AR\_MS\_AB_{t-1}$		−0.383*
		(0.225)
Control var.	Yes	Yes
YEAR	Yes	Yes
INDUSTRY	Yes	Yes
Constant	2.843***	2.920***
	(0.426)	(0.432)
N	171, 020	171, 020
Adj. R^2	0.192	0.191

In Panel A, we estimate columns (1) to (2) by Probit, columns (3) to (4) by Tobit, and columns (5) and (6) by ordinary least squares. In Panel B, we estimate columns (1) and (2) by ordinary least squares. ***, **, and * indicate 1%, 5%, and 10% significant, respectively.

Table 7
Consider various fixed effects.

Panel A: Include Year*Industry fixed effect (firm level)						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
	$FOLLOW_t$	$FOLLOW_t$	$ANALYST_t$	$ANALYST_t$	$FERR_t$	$FERR_t$
MDA_MS_{t-1}	1.209***		1.129***		−0.372**	
	(0.124)		(0.092)		(0.150)	
AR_MS_{t-1}		2.489***		2.286***		−0.802***
		(0.284)		(0.206)		(0.273)
Control var.	Yes	Yes	Yes	Yes	Yes	Yes
YEAR	Yes	Yes	Yes	Yes	Yes	Yes
INDUSTRY	Yes	Yes	Yes	Yes	Yes	Yes
*YEAR*INDUSTRY*	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−16.403***	−16.433***	−14.663***	−14.616***	4.140***	4.135***
	(0.682)	(0.691)	(0.411)	(0.404)	(0.925)	(0.926)
N	19,752	19,752	19,752	19,752	15,411	15,411
Pseudo R^2	0.278	0.278	0.199	0.199		
Adj. R^2					0.150	0.150

Panel B: Include Year*Industry fixed effect (analyst level)		
Variables	(1)	(2)
	$ERROR_t$	$ERROR_t$
MDA_MS_{t-1}	−0.429***	
	(0.103)	
AR_MS_{t-1}		−0.507**
		(0.199)
Control var.	Yes	Yes
YEAR	Yes	Yes
INDUSTRY	Yes	Yes
*YEAR*INDUSTRY*	Yes	Yes
Constant	3.190***	3.121***
	(0.613)	(0.616)
N	231, 663	231, 663
Adj. R^2	0.209	0.208

Panel C: Include Year*Province fixed effect (firm level)						
	(1)	(2)	(3)	(4)	(5)	(6)
	$FOLLOW_t$	$FOLLOW_t$	$ANALYST_t$	$ANALYST_t$	$FERR_t$	$FERR_t$
MDA_MS_{t-1}	1.240***		1.127***		−0.353**	
	(0.122)		(0.091)		(0.149)	
AR_MS_{t-1}		2.565***		2.252***		−0.796***
		(0.279)		(0.203)		(0.273)
Control var.	Yes	Yes	Yes	Yes	Yes	Yes
YEAR	Yes	Yes	Yes	Yes	Yes	Yes
INDUSTRY	Yes	Yes	Yes	Yes	Yes	Yes
*YEAR*PROVINCE*	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−16.797***	−16.715***	−14.818***	−14.687***	3.361***	3.331***
	(0.617)	(0.624)	(0.374)	(0.374)	(0.563)	(0.564)
N	19, 625	19, 625	19, 752	19, 752	15, 411	15, 411
Pseudo R^2	0.297	0.297	0.207	0.207		
Adj. R^2					0.155	0.155

Panel D: Include Year*Province fixed effect (analyst level)		
	(1)	(2)
	$ERROR_t$	$ERROR_t$
MDA_MS_{t-1}	−0.419***	
	(0.101)	
AR_MS_{t-1}		−0.501***
		(0.191)
Control var.	Yes	Yes
YEAR	Yes	Yes
INDUSTRY	Yes	Yes
*YEAR*PROVINCE*	Yes	Yes
Constant	3.190***	3.094***
	(0.549)	(0.550)
N	231, 663	231, 663
Adj. R^2	0.213	0.213

In Panels A and C, we estimate columns (1) to (2) by Probit, columns (3) to (4) by Tobit, and columns (5) and (6) by OLS. In Panels B and D, we estimate columns (1) and (2) by OLS. ***, **, and * indicate 1%, 5%, and 10% significant, respectively.

Table 8
The impact of industry-adjusted managerial sentiment on analyst following and earnings forecasts.

Panel A: Industry-adjusted managerial sentiment metric (firm level)						
	(1)	(2)	(3)	(4)	(5)	(6)
	$FOLLOW_t$	$FOLLOW_t$	$ANALYST_t$	$ANALYST_t$	$FERR_t$	$FERR_t$
$MDA\_MS\_adj_{t-1}$	1.165***		1.121***		−0.383***	
	(0.123)		(0.093)		(0.147)	
$AR\_MS\_adj_{t-}$		2.413***		2.272***		−0.805***
		(0.280)		(0.206)		(0.275)
Control var.	Yes	Yes	Yes	Yes	Yes	Yes
YEAR	Yes	Yes	Yes	Yes	Yes	Yes
INDUSTRY	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−15.489***	−15.912***	−14.056***	−14.401***	3.922***	4.043***
	(0.601)	(0.608)	(0.367)	(0.364)	(0.504)	(0.507)
N	19, 752	19, 752	19, 752	19, 752	15, 411	15, 411
Pseudo R^2	0.278	0.278	0.199	0.199		
Adj. R^2					0.150	0.150

Panel B: Industry-adjusted managerial sentiment metric (analyst level)		
	(1)	(2)
	$ERROR_t$	$ERROR_t$
$MDA\_MS\_adj_{t-1}$	−0.431***	
	(0.100)	
$AR\_MS\_adj_{t-1}$		−0.447**
		(0.196)
Control var.	Yes	Yes
YEAR	Yes	Yes
INDUSTRY	Yes	Yes
Constant	2.983***	3.083***
	(0.387)	(0.392)
N	231, 663	231, 663
Adj. R^2	0.197	0.196

In Panel A, we estimate columns (1) to (2) by Probit, columns (3) to (4) by Tobit, and columns (5) and (6) by ordinary least squares. In Panel B, we estimate columns (1) and (2) by ordinary least squares. ***, **, and * indicate 1%, 5%, and 10% significant, respectively.

Table 9
The moderating effect of corporate information environment: Earnings quality.

Panel A: Managerial sentiment in annual report						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
	High quality	Low quality	High quality	Low quality	High quality	Low quality
	$FOLLOW_t$	$FOLLOW_t$	$ANALYST_t$	$ANALYST_t$	$FERR_t$	$FERR_t$
AR_MS_{t-1}	2.839***	1.960***	2.543***	2.063***	−0.849**	−0.624
	(0.351)	(0.372)	(0.264)	(0.253)	(0.346)	(0.396)
Control var.	yes	yes	yes	yes	yes	yes
YEAR	yes	yes	yes	yes	yes	yes
INDUSTRY	yes	yes	yes	yes	yes	yes
Constant	−15.813***	−16.428***	−14.532***	−14.464***	3.458***	4.796***
	(0.819)	(0.713)	(0.475)	(0.425)	(0.632)	(0.767)
Observed coefficient difference between sub-samples	−0.879**		−0.480**		0.224	
Observations	9916	9836	9916	9836	7825	7586
Pseudo R^2	0.275	0.286	0.195	0.206		
Adj. R^2					0.152	0.148

Panel B: Managerial sentiment in MD&A						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
	High quality	Low quality	High quality	Low quality	High quality	Low quality
	$FOLLOW_t$	$FOLLOW_t$	$ANALYST_t$	$ANALYST_t$	$FERR_t$	$FERR_t$
MDA_MS_{t-1}	1.350***	0.972***	1.258***	0.959***	−0.524**	−0.177
	(0.162)	(0.154)	(0.120)	(0.116)	(0.212)	(0.200)

(*continued on next page*)

Table 9 (*continued*)

Panel B: Managerial sentiment in MD&A						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
	High quality	Low quality	High quality	Low quality	High quality	Low quality
	$FOLLOW_t$	$FOLLOW_t$	$ANALYST_t$	$ANALYST_t$	$FERR_t$	$FERR_t$
Control var.	yes	yes	yes	yes	yes	yes
YEAR	yes	yes	yes	yes	yes	yes
INDUSTRY	yes	yes	yes	yes	yes	yes
Constant	−15.818***	−16.417***	−14.643***	−14.503***	3.523***	4.780***
	(0.805)	(0.706)	(0.478)	(0.424)	(0.634)	(0.767)
Observed coefficient difference between sub-samples	−0.378**		−0.299***		0.347*	
Observations	9916	9836	9916	9836	7825	7586
Pseudo R^2	0.274	0.286	0.194	0.205		
Adj. R^2					0.153	0.148

Table 9 presents the results for the moderating effect of earnings quality (*EQ*) for the impact of managerial sentiment on analyst following and earnings forecast. We partition the full sample into high and low-quality information environment firms based on *EQ* by following Dechow and Dichev (2002). We do not present the coefficients of control variables for brevity. Variable definitions are presented in Table 1. ***, **, and * indicate 1%, 5%, and 10% significant, respectively.

Table 10
The moderating effect of information environment: Using future ROA.

Panel A: Managerial sentiment in annual reports						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
	High quality	Low quality	High quality	Low quality	High quality	Low quality
	$FOLLOW_t$	$FOLLOW_t$	$ANALYST_t$	$ANALYST_t$	$FERR_t$	$FERR_t$
AR_MS_{t-1}	3.258***	1.894***	2.431***	2.051***	−0.590**	−0.720
	(0.417)	(0.332)	(0.245)	(0.268)	(0.236)	(0.487)
YEAR	yes	yes	yes	yes	yes	yes
INDUSTRY	yes	yes	yes	yes	yes	yes
Other Controls	yes	yes	yes	yes	yes	yes
Constant	−18.111***	−14.960***	−13.448***	−15.389***	2.933***	5.750***
	(0.978)	(0.724)	(0.453)	(0.481)	(0.475)	(0.880)
Observed coefficient difference between sub-samples	−1.364***		−0.380*		−0.130	
N	9, 830	9, 922	9, 830	9, 922	8, 446	6, 965
Pseudo R^2	0.309	0.234	0.201	0.174		
Adj. R^2					0.151	0.112
Panel B: Managerial sentiment in MD&A						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
	High quality	Low quality	High quality	Low quality	High quality	Low quality
	$FOLLOW_t$	$FOLLOW_t$	$ANALYST_t$	$ANALYST_t$	$FERR_t$	$FERR_t$
MDA_MS_{t-1}	1.326***	1.056***	1.170***	0.997***	−0.422***	−0.091
	(0.189)	(0.143)	(0.115)	(0.123)	(0.144)	(0.257)
YEAR	yes	yes	yes	yes	yes	yes
INDUSTRY	yes	yes	yes	yes	yes	yes
Other Controls	yes	yes	yes	yes	yes	yes
Constant	−17.964***	−15.016***	−13.491***	−15.451***	2.967***	5.692***
	(0.976)	(0.708)	(0.451)	(0.485)	(0.478)	(0.874)
Observed coefficient difference between sub-samples	−0.271*		−0.174*		0.331*	
	9, 830	9, 922	9, 830	9, 922	8, 446	6, 965

(*continued on next page*)

Table 10 (*continued*)

Panel B: Managerial sentiment in MD&A						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
	High quality	Low quality	High quality	Low quality	High quality	Low quality
	$FOLLOW_t$	$FOLLOW_t$	$ANALYST_t$	$ANALYST_t$	$FERR_t$	$FERR_t$
Pseudo R	0.306	0.235	0.200	0.173		
Adj. R^2					0.151	0.112

Table 10 presents the results for the moderating effect of future *ROA* for the impact of managerial sentiment on analyst following and earnings forecast. We do not present the coefficients of control variables for brevity. Variable definitions are presented in Table 1. ***, **, and * indicate 1%, 5%, and 10% significant, respectively.

Table 11
The moderating effect of analyst ability.

Variables	(1)	(2)	(3)	(4)
	Star analyst	Non-star analyst	Star analyst	Non-star Star analyst
	$ERROR_t$	$ERROR_t$	$ERROR_t$	$ERROR_t$
MDA_MS_{t-1}	−0.265	−0.630***		
	(0.165)	(0.144)		
AR_MS_{t-1}			−0.479	−0.559**
			(0.327)	(0.262)
YEAR	yes	yes	yes	yes
INDUSTRY	yes	yes	yes	yes
Other Controls	yes	yes	yes	yes
Constant	2.583***	2.780***	2.539***	2.678***
	(0.580)	(0.456)	(0.582)	(0.463)
Observed coefficient difference between sub-samples	−0.365***		−0.080	
N	16,179	16,213	16,179	16,213
Adj. R^2	0.207	0.205	0.207	0.203

Table 11 presents the results for the moderating effect of star analyst for the impact of managerial sentiment on analyst following and earnings forecast. We do not present the coefficients of control variables for brevity. Variable definitions are presented in Table 1. ***, **, and * indicate 1%, 5%, and 10% significant, respectively.

or MD&A sections at *t-1*, analysts are more likely to follow the firm, and their earnings forecasts are more accurate at *t*. The findings are robust to alternative metrics of analyst behavior and managerial sentiment. In addition, we find that firms' information environment and analysts' ability moderate this effect. Overall, managerial sentiment revealed in annual reports' tone and MD&A sections is helpful to analysts' following decisions and forecast accuracy. Hence, managerial sentiment is valuable information in the financial market.

This study has two limitations. First, our findings are based on the Chinese context. Future studies should examine other markets. Second, we primarily use various fixed effects to account for potential endogeneity between managerial sentiment and analyst behavior. There may be other unresolved endogeneity issues. Future studies should include other methods to address these issues.

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Declaration of competing interest

We do not have any conflict of interest.

Appendix A.

Appendix A. Positive and negative tune keywords examples

Category	Chinese	English
Positive tone	进步	Progress
	自信	Confident
	令人满意的	Satisfactory
	突破	Breakthrough
	乐观	Optimistic
	……	……
Negative tone	令人担忧	Worrying
	加剧	Aggravate
	放弃	Abandon
	瓶颈	Bottleneck
	恶化	Deteriorate
	……	……

Appendix B. Methodology for extracting information from MD&A and sample key words (underlined)

Sample statements (original in Chinese)	Firm ticker number and year of information
We made significant progress in building our brand, management, and potential in our watches. Overall, the operation is smooth.	000026; 2012
In 2017, we advanced our technology and broke through our bottleneck to enhance our products. The quantity and quality of our products significantly improved.	000045; 2017
In 2014, through the management and workers' hard work, our overall performance was satisfactory.	002245; 2014
In 2019, while facing challenges in the economic and business environments, we are confident in our future.	300389; 2019
While facing challenges and operating pressure, we maintain a positive outlook.	600636; 2016
Due to the high oil price and pressure from the high-speed rail competition, our operating pressure worsened.	600115; 2011
The global trade is shrinking. Unemployment is rising. The national deficit is troublesome. The adverse impact of the Global Financial Crisis remains. The recovery of the global economy is uncertain.	601989; 2009

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