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Inconsistency across short-term and long-term oriented signals: Effect on investor reactions

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ABSTRACT

We examine how investors evaluate firms when they receive inconsistent signals with different temporal orientations—short-term signals about the firm's status quo versus long-term signals about its prospects. We propose that shareholders react negatively to increased long-term investments, like R&D, when managers express negative sentiments about the firm's current status. Drawing on signaling and cognitive dissonance theories, we argue that these inconsistent signals cause cognitive dissonance for investors, leading to risk-averse decisions. Analyzing public firms in China from 2008 to 2020, we find that higher R&D intensity amplifies the negative impact of management's negative sentiment on market reaction. This effect is stronger with higher transient institutional ownership and lower managerial ownership. By focusing on signal inconsistency across different temporal frames, this study aims to better understand how investors evaluate a firm's long-term investments in light of managers' sentiments about the current state.

1. Introduction

Investors rely on the signals conveyed by a firm to make investment decisions due to the asymmetric information in the market about the true value of the firm (Connelly, Certo, Ireland, & Reutzel, 2011; Connelly, Certo, Reutzel, DesJardine, & Zhou, 2024; Healy & Palepu, 2001; Spence, 1973). Research on signaling theory has suggested that investors receive multiple signals and interpret them simultaneously as a set (Drover, Wood, & Corbett, 2018; Paruchuri, Han, & Prakash, 2021; Plummer, Allison, & Connelly, 2016; Vergne, Wernicke, & Brenner, 2018; Zhang, Zhang, & Jia, 2022). Consistent signals from a firm amplify the signaling effect as they corroborate each other (Stern, Dukerich, & Zajac, 2014). Conversely, inconsistent signals introduce ambiguity due to their contradictory content (Yao, Fang, Dineen, & Yao, 2009).

Existing research on signal inconsistency is predominantly based on the assumption that inconsistent signals occur solely within the same *temporal* orientation (e.g., Paruchuri et al., 2021; Rhee & Haunschild, 2006; Wang & Choi, 2010; Yao et al., 2009; Zhang et al., 2022). For example, divergent customer feedback on a firm's newly introduced product provides incongruent signals about the product's current quality, representing short-term oriented signal inconsistency (Yao et al., 2009). In contrast, a firm's significant investment in organizational environmental sustainability combined with its managers' low supervisory environmental support creates uncertainty for investors regarding the firm's long-term commitments, exemplifying long-term oriented signal inconsistency (Zhang et al., 2022).

However, when signals from firms across different temporal orientations differ in nature—for instance, one suggesting questionable short-term profitability and another indicating aggressive long-term investments—audiences perceive this temporal incongruence and attempt to resolve it (Drover et al., 2018: 224). Therefore, our aim is to investigate how investors evaluate a firm that conveys inconsistent signals across different temporal dimensions (i.e., inconsistency between a firm's short-term signals about its status quo and long-term signals about its prospects). This question is important because it challenges the assumption in signaling theory that inconsistency only occurs within the same temporal dimension and responds to calls in the literature for a deeper understanding of how investors may engage in a more holistic evaluation of a firm based on its conveyed signals (Drover et al., 2018: 225; Paruchuri et al., 2021).

We consider a firm's intensified investments in R&D as positive long-term oriented signals regarding its prospects (Barker & Mueller, 2002;

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Eberhart, Maxwell, & Siddique, 2008; Wang, Li, & Wei, 2022). However, investors may interpret these as inconsistent signals when juxtaposed with managers' negative sentiment expressed during conference calls, which reflects immediate concerns about the firm's current status and raises suspicions about short-term profitability (Davis, Piger, & Sedor, 2012; Davis & Tama-Sweet, 2012; Feldman, Govindaraj, Livnat, & Segal, 2010; Jiang, Lee, Martin, & Zhou, 2019). Drawing on cognitive dissonance theory (Festinger, 1957), we propose that the inconsistency between short-term and long-term oriented signals induces cognitive dissonance among investors, leading them to make risk-averse decisions to resolve this psychological discomfort. Consequently, the adverse effect of managers' negative sentiment on market reactions is amplified when the firm's R&D investment level is high. We further investigate how a firm's transient institutional ownership and managerial ownership moderate the effect of temporally inconsistent signals, as these ownership structures influence the firm's temporal horizon (Alessandri, Mammen, & Eddleston, 2018; Bushee, 1998; Hsu & Koh, 2005; Jensen & Meckling, 1976; Kim, Kim, Mantecon, & Song, 2019; Sakaki & Jory, 2019).

We conducted our research on public firms in China between 2008 and 2020. To capture managers' sentiment toward their firms' status quo, we adopted a textual analysis approach, gathering information from conference call transcripts. These calls are an increasingly popular practice and serve as a new channel for Chinese public firms to communicate their current situation and future prospects to investors. Our results, based on a panel dataset of 1,947 publicly listed Chinese firms, indicate that increased R&D investment intensity amplifies the negative effect of management's negative sentiment towards a firm's status quo on its market reaction. This amplification effect is stronger in firms with higher levels of transient institutional ownership and lower levels of managerial ownership.

This study contributes to the growing body of research on signal inconsistency within the signaling theory literature (Connelly et al., 2011; Connelly et al., 2024; Paruchuri et al., 2021; Vergne et al., 2018). In particular, we challenge the implicit assumption that signal inconsistency only occurs within the same temporal orientation (Drover et al., 2018: 225) by demonstrating that investors tend to evaluate a firm holistically, considering signals with different temporal orientations as a set. We also contribute to the literature on cognitive dissonance by showing how individuals seek to reduce cognitive dissonance when receiving contradictory signals with different temporal orientations. This uncomfortable psychological state caused by inconsistency across short-term and long-term oriented signals has been largely ignored in prior research (Festinger, 1957; Hinojosa, Gardner, Walker, Cogliser, & Gullifor, 2016). Finally, we extend the R&D investment literature by highlighting the potential adverse effect of R&D investment on market reaction. Specifically, when investors perceive negative signals about a firm's short-term profitability, the potential future performance benefits signaled by greater R&D commitments can exacerbate investors' negative evaluations of the firm.

The structure of this article is as follows: Section 2 presents the theoretical background and hypotheses development. Section 3 introduces the methodology used in this study, followed by Section 4, which shows the results. In Section 5, we discuss the theoretical and practical implications of our research, address the limitations, and suggest potential directions for future research. Finally, we conclude our study in Section 6.

2. Theoretical background and hypotheses development

2.1. Information asymmetry and signal processing in capital markets

Information asymmetry constitutes a fundamental determinant in decision-making processes, introducing significant uncertainties into various market contexts (Akerlof, 1970; Alinasab, Mirahmadi, Ghorbani, & Caputo, 2022; Frankel & Li, 2004; Zahorodniy, Kryvtsun, & Partyn, 2015). Within capital markets, the asymmetric distribution of information between internal management and external investors represents a particularly salient issue, materially affecting investment decision-making processes (Frankel & Li, 2004). Corporate managers inherently possess privileged access to comprehensive internal information that is not readily available to external shareholders. Consequently, this information asymmetry may precipitate elevated costs of capital, as investors face considerable challenges in accurately evaluating firms' intrinsic values and risk profiles under conditions of uncertainty (Healy & Palepu, 2001). To mitigate investors' informational disadvantages and ameliorate their hesitation in capital allocation decisions, firms engage in voluntary and mandatory disclosure practices, disseminating detailed financial and operational information to narrow the information gap and enhance investor confidence. From an investor perspective, both intentional and inadvertent firm disclosures generate distinct signals that substantively influence their investment decision-making frameworks.

In conditions of uncertainty, individuals fundamentally rely on received signals to inform their decision-making processes (Avinadav & Shamir, 2021; Healy & Palepu, 2001; Spence, 1976), wherein the interpretation of these signals entails complex cognitive mechanisms. When evaluating firms' prospective market trajectories, investors necessarily employ subjective interpretative frameworks to process informational signals (Asay, Hales, Hinds, & Rupar, 2023; Hadar & Fox, 2009). This subjective evaluation process is substantively mediated by psychological and cognitive factors, particularly prior experience (Alinasab et al., 2022) and established trust relationships (Chen & Huan, 2020; Lins, Servaes, & Tamayo, 2017). Moreover, in formulating coherent investment strategies, investors must synthesize diverse and potentially discordant signals—whether intentionally or unintentionally conveyed by firms—into a unified analytical framework. The inherent complexity of signal interpretation and the potential for signal inconsistency thus emerges as a critical consideration in examining investor decision-making within capital markets.

2.2. Signaling theory and signal inconsistency

Signaling theory provides a sophisticated theoretical framework for examining communicative processes within contexts characterized by information asymmetries (Connelly et al., 2011; Connelly et al., 2024; Drover et al., 2018; Spence, 1973). Signal recipients—whether individuals or collective entities—external to an organization and confronted with insufficient information for accurate organizational valuation, frequently utilize observable organizational attributes and behaviors as evaluative mechanisms to mitigate uncertainty in their assessment processes (Akerlof, 1970; Avinadav & Shamir, 2021; Connelly et al., 2011; Elitzur & Gavious, 2003; Hadar & Fox, 2009; Healy & Palepu, 2001; Spence, 1973). These recipients typically process multiple signals concurrently, engaging in simultaneous interpretation of signal portfolios while evaluating their internal consistency to formulate cognitive assessments and subsequent behavioral responses (Connelly et al., 2011; Connelly et al., 2024; Demasi & Voegtlin, 2023; Drover et al., 2018). Notably, Drover and colleagues (2018) advance the theoretical conceptualization through their introduction of signal sets and a dual-process framework, emphasizing the necessity for enhanced scholarly investigation into the cognitive dimensions of multiple signal interpretation.

Centering on signal inconsistency during the communication process, studies have also explored receivers' interpretations of signals in unidirectional congruence (e.g., Stern et al., 2014), and of signals with different strengths (Branzei, Ursacki-Bryant, Vertinsky, & Zhang, 2004), highlighting the importance of signal (in)consistency in receivers' evaluation. For example, Wang and Choi (2010) find that the level of corporate social performance and two types of consistency interact to positively affect a firm's financial performance. Similarly, Zhang et al. (2022) propose that inconsistent information cues about environmental

support from the organization and supervisor (i.e., the firm's words and deeds) increase employees' perception of corporate hypocrisy, which in turn inhibits employee green behaviors.

Nevertheless, existing studies on signal inconsistency are grounded upon the implicit assumption that inconsistent signals occur solely within the same *temporal* orientation (e.g., Miyazaki, Grewal, & Goodstein, 2005; Paruchuri et al., 2021; Rathee, Masters & Yu-Buck, 2022; Rhee & Haunschild, 2006; Wang & Choi, 2010; Yao et al., 2009; Zhang et al., 2022). However, firms' signals also bear the attributes of different temporal orientations. When signals from firms across different temporal orientations differ in nature—for instance, one suggesting questionable short-term profitability about a firm's status quo and another indicating the firm's aggressive long-term oriented investments—audiences tend to perceive this temporal incongruence and attempt to resolve it (Drover et al., 2018: 224). But we still do not know how receivers comprehensively interpret inconsistent signals with different temporal orientations. The lack of discussion on signal inconsistencies across different temporal frames results in an incomplete understanding of the corporate communication process from the temporal perspective, which is of vital importance in organizational research (Ancona, Goodman, Lawrence, & Tushman, 2001; Bansal, Shipp, Crilly, Jansen, Okhuysen & Langley, 2024; Foerderer & Schuetz, 2022; Xu, Wang, Zhu, & Zhuang, 2024). In this sense, focusing on signals with different temporal orientations is essential, and the effect of firms' temporally inconsistent signals needs further examination. Therefore, in this study, we examine how firms' inconsistent signals across different temporal dimensions (i.e., inconsistency between a firm's short-term signals about its status quo and long-term signals about its prospects) affects investors' subsequent evaluations and decisions.

2.3. Influence of management sentiment on market reaction

Stock market investors are common information receivers in management research (Gao, Yu, & Cannella, 2016; Kang, 2008; Park & Mezias, 2005). They tend to evaluate firms' prospects based on the signals exhibited by managers on various occasions, because both firms and investors exist within an asymmetric information market (Bergh, Connelly, Ketchen Jr, & Shannon, 2014). As one of the most important communication tools, managers' sentiment is a primary signal that investors often use to assess a firm. Indeed, managers' sentiment can affect stock market reactions in multiple contexts and samples (e.g., Davis et al., 2012; Jiang et al., 2019). Specifically, prior studies have shown that managers' sentiment on firm performance varies, and it is associated with short-term market reactions (Davis & Tama-Sweet, 2012; Feldman et al., 2010).

Moreover, positive or negative sentiments exhibited by managers can affect receivers' evaluations differently. As documented in prior studies, a more positive tone in earnings press releases can positively affect investors' reactions to earnings announcements (Henry, 2008). MacGregor, Slovic, Dreman and Berry (2000) also find that words with positive meanings can trigger favorable images of the objects in people's minds and influence their subsequent judgments. The implicit premise is that, compared with neutral language, expressing identical content with positive words triggers more favorable reactions from audiences. Following this logic, content that conveys negative sentiment induces audiences' negative cognition and evaluation (Jegadeesh & Wu, 2013). Therefore, consistent with prior research (e.g., Davis et al., 2012; Jiang et al., 2019), we articulate a baseline hypothesis as follows:

Baseline hypothesis: Managers' negative sentiment toward a firm's status quo is negatively associated with its market reaction.

2.4. Effect of temporally inconsistent signals on market reaction

While the sentiment sent by managers about a firm's status quo may affect investors' evaluations, we argue that it explains only a small portion of the variance in audience reactions to signals. Therefore, we theorize that a firm's long-term oriented investment serves as a kind of long-term oriented signal indicative of the firm's sustainable performance in the future, joining the effect of managers' sentiment toward the firm's status quo on investors' perceptions. Specifically, drawing on the cognitive dissonance perspective, we argue that a firm's greater long-term oriented investments, together with managers' negative sentiment toward the status quo of the firm, send temporally inconsistent signals that lead to elevated negative evaluations of the firm by investors.

Cognitive dissonance theory suggests that when individuals hold two or more cognitions that are contradictory or inconsistent, they will feel cognitive dissonance until they resolve this unpleasant psychological state (Festinger, 1957). Festinger (1957) defines cognitions as any mental representation, including attitudes, beliefs, or knowledge of one's behaviors. Dissonance is a negative affective state that results from an individual's discrepant cognitions. This uncomfortable state motivates individuals to reduce the magnitude of dissonance through many methods, such as altering the original cognitions, adding or subtracting cognitions (e.g., new attitudes, beliefs), or adjusting the importance of the cognitions (e.g., Belanche, Casaló, Flavián, & Ibáñez-Sánchez, 2021; Festinger, 1957). Although cognitive dissonance theory was first introduced within the field of social psychology, it has been widely used in management research (e.g., Chatterjee, Chaudhuri, Kumar, Wang, & Gupta, 2023; Hinojosa et al., 2016; Westphal & Bednar, 2008), and its logic can help us analyze the process through which receivers derive discrepant cognitions from temporally inconsistent signals and how they react to the inconsistencies in signals that have different temporal orientations.

2.4.1. R&D investment

In this research, we focus on firms' R&D investments, an important type of investment which indicates the firm's resource commitments and its value-creating strategies with long-term pay-offs (Barker & Mueller, 2002; Papa, Mazzucchelli, Ballestra, & Usai, 2022). Importantly, the extent to which firms may benefit from R&D can be affected by time lag, uncertainty, risks, and various costly characteristics of such investment (Eberhart et al., 2008). R&D investments are likely to be subject to failure and rejected by the market, thus years of input can be in vain (Wang et al., 2022). We propose that management's sentiment toward the status quo of the firm, a key reference point for audiences to evaluate firms' market potential, will be interpreted in light of the firm's investment in R&D activities, which signals the potential of firms to generate sustained profits in the future. Therefore, the temporally inconsistent signals between management's negative sentiment toward firms' status quo and firms' higher R&D investments will increase the discrepancy of investors' cognition of the future success of R&D activities. The reasons for this are discussed below.

Established research suggests that long-term investments in R&D activities are associated with high outcome uncertainty in the future because of the high degree of information asymmetry and opacity connected with such investments (Keupp & Gassmann, 2009; Wang et al., 2022; Alinasab et al., 2022). Under these circumstances, investors tend to predict the pay-offs of R&D investments by collecting information from other sources. Managers' sentiment is often considered as an important signal during the evaluation process. While shareholders do not necessarily hold back firms' resource input in R&D activities with high risk and uncertainty, the signals regarding firms' status quo may affect investors' perceptions of these long-term oriented investments. In other words, even though investors are likely to have positive cognitions about a firm's prospects of higher R&D investment, when managers express negative sentiment toward the firm's status quo, investors are likely to think that things are going poorly (e.g., Jegadeesh & Wu, 2013); they may suspect that the firm's high R&D investments are high-risk bets (Schepker, Oh, & Patel, 2016) that will probably not pay off because the negativity from the manager is associated with firm failure (Smith &

Taffler, 2000). In this way, management's negative sentiment toward a firm's status quo causes investors to experience cognitive dissonance. In this context, one of the ways in which audiences reduce cognitive dissonance is by altering cognitions (Festinger, 1957). For instance, previous studies have shown that individuals will alter attitudes to reduce dissonance (Avital, 2000), and employees tend to change attitudes, behaviors, or other cognitions to avoid the experience of dissonance arousal (Hinojosa et al., 2016).

How, then, do investors alter their attitudes regarding long-term activities or short-term oriented signals to resolve the dissonance? Established studies suggest that when multiple signals on an object are inconsistent, the less favorable one is given greater weight than the positive one and will dominate individuals' cognitive processing of information (Anderson, 1981, 1996; Maheswaran & Chaiken, 1991; Zhang et al., 2022). Other evidence from cognition and behavior research suggests that individuals tend to exhibit loss aversion (Kahneman, Knetsch, & Thaler, 1991; Kahneman & Tversky, 1979) and thus make decisions to mitigate risk to protect current (endowed) wealth rather than prospective (potential future) wealth (Martin, Gomez-Mejia, & Wiseman, 2013; Martin, Wiseman, & Gomez-Mejia, 2016). Similar arguments that people often place more weight on the present than on the future, and the behavioral propensity of individuals to discount future gains, can be found in neuroeconomics and psychology (Dasgupta & Maskin, 2005; Frederick, Loewenstein, & O'Donoghue, 2002; Harris & Laibson, 2001; Laibson, 1997). Additionally, Alinasab et al (2022) suggest that decision-makers need to minimize their current investment when the level of uncertainty is high. In this vein, individuals prefer present rewards to later pay-offs because they are present-biased, and tend to change attitudes toward long-term activities rather than toward short-term signals when facing inconsistency.

Therefore, we posit that when faced with temporally inconsistent signals between managers' negative sentiment toward firms' status quo and firms' higher long-term investments in R&D, investors become more dubious about the prospects of firms' R&D activities and they restore cognitive balance by altering attitudes on the bright future potentially brought about by R&D activities. In this circumstance, investors' tendency to reduce the uncomfortable cognitive dissonance through adjusting cognition on R&D pay-offs to align with negative sentiment results in investors' discounted evaluations and impaired judgments of R&D investments. Hence, the punitive effect of managers' negative sentiment will be more pronounced when fostered by high levels of R&D investment. We hypothesize the following:

Hypothesis 1 (H1): A firm's higher R&D intensity strengthens the negative effect of managers' negative sentiment toward the firm's status quo on its market reaction.

2.5. Boundary conditions: Transient institutional ownership and managerial ownership

Although we posit that inconsistent signals with different temporal orientations elicit negative market response, investors' perceptions of such an inconsistency are not equal for firms with different ownership structures, as these structures influence firms' temporal horizon in making strategic decisions—i.e., corporate short-termism versus long-termism (Alessandri et al., 2018; Bushee, 1998; Hsu & Koh, 2005; Jensen & Meckling, 1976; Keum, 2021; Kim et al., 2019; Sakaki & Jory, 2019). Specifically, we expect that the negative market reaction to the temporally inconsistent signals amplifies (attenuates) as the firm's short-termism (long-termism) increases. Drawing from earlier research on the relationship between firm ownership structure and temporal horizon in corporate strategic decision-making, we focus on transient institutional ownership and managerial ownership as the boundary conditions.

2.5.1. Transient institutional ownership

Investors vary in their willingness to wait for returns on their investments in firms. Transient institutional investors frequently move from one short-term investment to the next (Bushee, 1998), rapidly altering their investment portfolios (Zhang & Gimeno, 2016). In contrast, dedicated institutional investors with large, long-term holdings typically have a greater interest in the long-term value of their portfolio firms (Bushee, 1998; Eccles, Ioannou, & Serafeim, 2014; Shi, Connelly, & Hoskisson, 2017).

One apparent feature of transient institutional investors is that they are myopic, seeking short-term trading profits and placing excessive focus on current earnings (Bushee, 1998; Hsu & Koh, 2005; Kim et al., 2019). Aligned with this logic, transient institutional investors tend to adopt a short investment horizon and are less likely to devote time or resources to considering firms' long-term investments (e.g., Hsu & Koh, 2005; Kim et al., 2019; Porter, 1992), thus inducing short-term oriented strategic decision-making by firms. Hence, we propose that when firms have a higher level of transient institutional ownership, managers will pay more attention to short-term profits and will tend to adopt myopic strategies. Under such circumstances, even though a firm may make a greater investment in R&D activities, investors experiencing the signals revealed in management's negative sentiments about a firm's current situation would interpret the firm's higher long-term oriented investments as a less credible signal. As a result, the investors would have lower confidence in a firm's future growth and pay more attention to the firm's short-term return. In light of this, the punitive effect of temporally inconsistent signals will be more pronounced when the firm has more transient institutional ownership.

In contrast, previous studies have found that long-term oriented investors (i.e., dedicated investors) can make their investment firms more independent from the short-term pressures of the capital market (Higgins & Gulati, 2006; Zhang & Gimeno, 2016) and increase the tolerance for business failure (Connelly, Shi, Hoskisson, & Koka, 2019). A recent study also illustrates that dedicated institutional investors who are long-term oriented, focused, and committed are more likely to gather in-depth private information about their investments, devote effort to understanding firms' strategies, and reduce capital market pressures, thus encouraging CEOs to pursue more innovative strategies, which can be an important way for managers to create long-term value (Oehmichen, Firk, Wolff, & Maybuechen, 2021). Hence, compared to firms with a higher proportion of shares held by transient institutional investors, the temporal horizon of firms that have more dedicated institutional ownership is much longer. This long-termism manifests in such firms' strategic decisions, because dedicated institutional investors tend to adopt a "buy and hold" investment philosophy as opposed to a "trading" philosophy (Sakaki & Jory, 2019). We argue that when firms have less transient institutional ownership (more dedicated institutional ownership), managers are likely to focus more on long-term development, and thus the firm's strategic long-termism increases. In such cases, investors would believe in the credibility of the signal conveyed by a firm's higher R&D investments and tolerate the firm's short-term underperformance rather than punishing the firm when the manager expresses negative sentiment toward the firm's status quo.

Taken together, we expect that the negative effect of temporally inconsistent signals on market reaction will be amplified if the firm has more transient institutional ownership. Therefore, we hypothesize the following:

Hypothesis 2 (H2): The negative effect of managers' negative sentiment toward a firm's status quo on its market reaction in the context of the firm's higher R&D intensity will be greater for those firms that have more transient institutional ownership.

2.5.2. Managerial ownership

Managerial ownership—the proportion of ordinary shares held by firms' managers—reduces agency costs because it aligns managerial

interests with those of shareholders (Jensen & Meckling, 1976) and encourages managers to take firms' development or stock price into consideration when making strategic decisions (Alessandri et al., 2018; Jensen & Murphy, 1990). It also indicates managers' confidence in the firm's future prospects in the long term and functions as a signal of the firm's temporal horizon in making strategic decisions.

When managers have a higher stock ownership of the firm they manage, its investors tend to perceive this as an indicator of the firm's long-termism and thus are inclined to be more patient in waiting for the firm's R&D investments to pay off, even if the firm sends negative signals about its short-term profitability. In this sense, the punitive effect of temporally inconsistent signals will be less salient when the firm has more managerial ownership. In contrast, if managerial ownership is at a lower level, investors would interpret this as a signal of managers' lower confidence in a firm's future growth and a shorter temporal horizon in strategic decision-making; this, in turn, would strengthen the investor short-termism effect. In this case, investors tend to perceive a firm's higher R&D investments as a less credible signal and thus are more sensitive to managers' negative sentiment on the firm's status quo. In sum, firms with less managerial ownership suffer greater negative effects of inconsistent signals with different temporal orientations. Therefore, we hypothesize that:

Hypothesis 3 (H3): The negative effect of managers' negative sentiment toward a firm's status quo on its market reaction in the context of the firm's higher R&D intensity will be greater for those firms that have less managerial ownership.

Fig. 1 illustrates the theoretical model of this study.

3. Method

3.1. Data and sample

We conducted our research in the empirical context of Chinese public firms' conference calls between 2008 and 2020. We constructed the dataset using the following procedures. First, we gathered the transcripts of the conference calls conducted by public firms in China from the Chinese Research Data Services (CNRDS) database. CNRDS is a source of data about public firms in China and has been widely used in prior studies (e.g., Gu, Shi, Wang, & Xu, 2022; Lv, Zhu, Chen, & Lan, 2021). We also collected detailed transcripts of audiences' questions and the management's replies during conference calls from the Shanghai and Shenzhen Stock Exchange websites. Then we triangulated the two sources of transcripts by looking through the information, including the exact time the conference calls were held, the participants, and all the questions and answers. This process ensured the accuracy of our data.

Next, we obtained other firm-specific information such as financial data, corporate governance, and information on firms' senior executives from China Stock Market Accounting Research (CSMAR), which has also been frequently used in other studies (e.g., Fan, Wong, & Zhang, 2007; Wang, Wang, Xu, & Yuan, 2017). In addition, we used an index developed by the National Economic Research Institute of China to measure the institutional environment of the provinces where the firms were headquartered, because the quality of the institutional environment may affect investors' perceptions of a firm's operation and transaction efficiency, thus affecting their decisions and stock market reactions. This index has been validated and has been widely used in other studies (e.g., Jia, Huang, & Zhang, 2019; Li & Qian, 2013). Last, we combined and matched the data from these different databases to form a set of panel data of Chinese public firms from 2008 to 2020.

3.2. Estimation method

Following prior studies (e.g., Haleblian, Pfarrer, & Kiley, 2017; Shen, Tang, & Chen, 2014; Tong, Wang, & Xia, 2019), we use the financial event study method to conduct the analysis. This method helps us capture investors' reactions in the stock market; that is, our dependent variable. In line with existing research (e.g., Bose, Minnick, & Shams, 2021), we use ordinary least squares (OLS) models with year and industry fixed effects in the analyses, because our dependent variable is a continuous variable with normal distribution.

3.3. Variables and measures

Dependent variable. Consistent with prior studies, we use the *cumulative abnormal returns (CARs)* around the conference calls' dates to measure the market reactions of investors to the information disclosed in the conference calls. We use financial event study analysis to calculate the sum of abnormal stock returns for each day in the event window [−1, +1]. Specifically, the abnormal return (AR) on day *t* was estimated through the following formulation: $AR_{it} = R_{it} - E(R_{it})$, where R_{it} is the daily stock return of a focal firm and $E(R_{it})$ is the expected daily stock return predicted by the daily stock market return on day *t*. AR_{it} is the actual daily stock return minus the expected daily stock return. For better coefficient expression, the CARs were multiplied by 100 (Tong et al., 2019).

Independent variable. Management's *negative sentiment* is our key explanatory variable. The conference call transcripts were analyzed through the textual analysis method used in previous studies (e.g., Hu, Shohfi, & Wang, 2021; Pan, McNamara, Lee, Haleblian, & Devers,

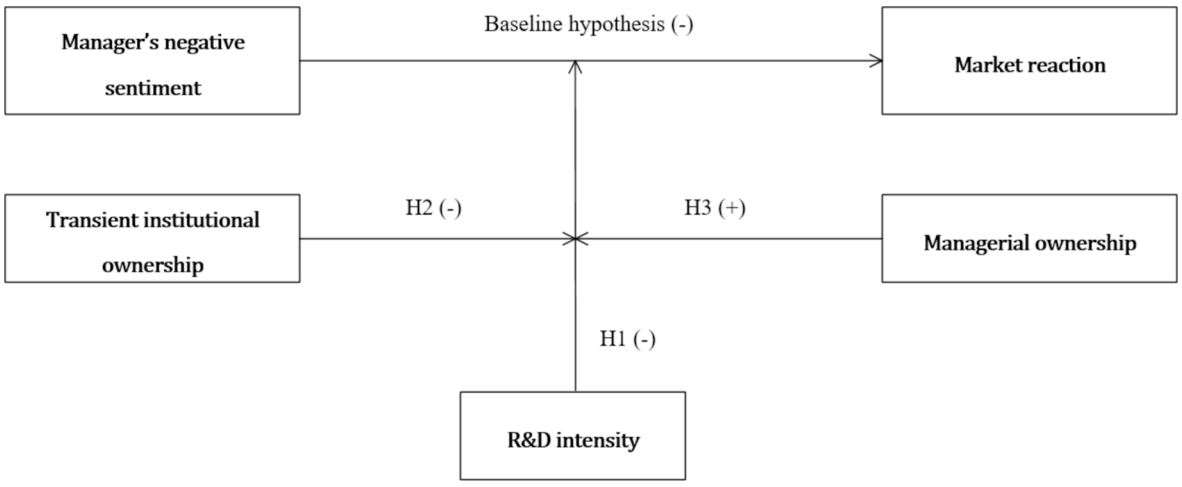

Fig. 1. Theoretical model.

2018). The words in the transcripts were judged as negative or positive based on a Chinese dictionary translated from the English dictionary developed by Loughran and McDonald (2011). This ensures the judgments were made with authority and that they conformed to the special grammatical structure in the Chinese context. We obtained the sentiment words of managers expressed in the conference calls and then calculated the level of negative sentiment. According to studies in finance and accounting (e.g., Henry, 2008; Henry & Leone, 2015), *negative sentiment* is measured by the ratio of negative word count to the total word count. The value of a negative sentiment ranges from 0 to 1; the higher the value, the more negative sentiment was expressed by management on the conference call.

Moderators. We use three moderator variables to test the effect of inconsistent signals between managers' negative sentiment toward the firm's status quo and R&D investments, and whether the effect of temporally inconsistent signals on market reaction (i.e., CARs) concentrates within firms with certain characteristics. The first measure we use is firms' *R&D intensity*. Following prior research (e.g., Hu, Gentry, Quigley, & Boivie, 2021; Leung & Sharma, 2021), we calculated firms' R&D intensity as the ratio of firms' R&D expenditures to total sales, and replaced missing values for R&D expenditure with zeros.

The second moderator is firms' *transient institutional ownership*. Referring to established studies on the classification of transient and dedicated institutions according to their portfolio turnover over the past four quarters (Erhemjamts & Huang, 2019; Gaspar, Massa, & Matos, 2005; Yan & Zhang, 2009), we calculated the transient and dedicated institutional ownership for each public firm. Specifically, we first calculated the aggregate purchase and sale for each institution in each quarter. The formula is below:

$$CR\_buy_{k,t} = \sum_{i=1}^{N_k} |S_{k,i,t}P_{i,t} - S_{k,i,t-1}P_{i,t-1} - S_{k,i,t-1}\Delta P_{i,t} | if S_{k,i,t} > S_{k,i,t-1}$$

$$CR\_sell_{k,t} = \sum_{i=1}^{N_k} |S_{k,i,t}P_{i,t} - S_{k,i,t-1}P_{i,t-1} - S_{k,i,t-1}\Delta P_{i,t} | if S_{k,i,t} \leq S_{k,i,t-1}$$

where $P_{i,t}$ and $P_{i,t-1}$ are the share prices for stock i at the end of quarter t and $t-1$, $S_{k,i,t}$ and $S_{k,i,t-1}$ are the number of shares of stock i held by investor k at the end of quarter t and $t-1$, respectively. $CR\_buy_{k,t}$ and $CR\_sell_{k,t}$ are institution k's aggregate purchase and sale for quarter t, respectively. Institution k's churn (or turnover) rate for quarter t was then defined in the formula below, in which the minimum of aggregate purchase and sale can minimize the impact of investor cash flows on portfolio turnover:

$$CR_{k,t} = \frac{\min(CR\_buy_{k,t}, CR\_sell_{k,t})}{\sum_{i=1}^{N_k} \frac{S_{k,i,t}P_{i,t} + S_{k,i,t-1}P_{i,t-1}}{2}}$$

Next, we calculated each institution's average churn rate over the past four quarters as:

$$AVG\_CR_{k,t} = \frac{1}{4}\sum_{j=0}^{3} CR_{k,t-j}$$

We then sorted all institutional investors into three tercile portfolios on the basis of the average churn rate over the past four quarters. Those ranked in the top tercile (with the highest $AVG\_CR_{k,t}$) were classified as transient institutional investors and those ranked in the bottom tercile were classified as dedicated institutional investors. Finally, for each stock, we computed the transient (dedicated) institutional ownership as the ratio between the number of shares held by transient (dedicated) institutional investors and the total number of outstanding shares.

The third moderator is *managerial ownership*. Consistent with prior research (e.g., Fahlenbrach & Stulz, 2009; Jensen & Meckling, 1976; Johnson & Greening, 1999), it was measured by the proportion of firm equity owned by a firm's top management team.

Control variables. We include a battery of control variables in our models. We control for management's *positive sentiment,* which shows the amount of positive sentiment expressed by managers on the conference call. It was measured by the ratio of positive word count to the total word count. We also control for the *firm Tobin's Q*, measured by the ratio of a firm's market value to its total assets. *Firm leverage* was measured by the ratio of total liabilities to total assets. *Cash flow per share* is the firm's operating cash flow per share. *Sales turnover* was measured by the ratio of sales to total assets. *Firm age* was calculated by year t minus the firm's listing year. *Firm size* was measured by the natural logarithm of a firm's total employees. *Tangibility* was measured by the ratio of property, plant, and equipment to total assets. We consider whether the firm is a state-owned enterprise (*SOE*) by including a dummy variable classified by the total proportion of state shares represented within the firm's top five shareholders. This was coded as 1 if the proportion of shares held by the state was more than 50 %, and 0 otherwise.

In addition, we control for factors related to the firm's top management team and corporate governance. For example, we control for the *shareholder number*, measured by the natural logarithm of shareholder numbers in the given year. *First shareholder proportion* was calculated by the proportion of shares held by the largest shareholder. *CEO age* was calculated by subtracting a CEO's birth year from year t. *CEO duality* was coded as 1 if the roles of CEO and chairman were combined, and 0 otherwise. *CEO gender* was coded as 1 if the CEO was male, and 0 otherwise. *CEO financial background* was coded as 1 if the CEO had financial employment or study experience, and 0 otherwise. *CEO education* was measured by a categorical variable capturing the CEO's education level.

At the regional level, as noted earlier, we consider the institutional environment because it may affect investors' perceptions of a firm's transaction efficiency, thus affecting stock market fluctuations. We use the *marketization index*, which measures the marketization of regions, and which was developed by the National Economic Research Institute to capture this effect (Wang, Fan, & Hu, 2019). We also include year and industry dummies in the models. The industry dummy variable was classified by the three-digit industry codes of the firms.

4. Results

Table 1 presents the descriptive statistics and the correlation of our key variables. To check potential multicollinearity, we conducted a variance inflation factor (VIF) test and found that the maximum (mean) VIF was 1.58 (1.18), less than the threshold value of 10, suggesting that multicollinearity is unlikely to be a concern in our sample (O'Brien, 2007). The correlation matrix shows that management's positive sentiment correlates positively with the CARs measure (the coefficient is 0.02, $p < 0.05$). In contrast, management's negative sentiment is negatively correlated with CARs around the event window (the coefficient is −0.04, $p < 0.01$), consistent with our baseline arguments.

4.1. Main results

Table 2 reports the primary results of our regressions predicting firms' cumulative abnormal returns (CARs) around the dates of the conference calls with the event window of [-1, +1]. Model 1 only includes control variables. Model 2 examines the baseline hypothesis, including management's *negative sentiment*. The estimated coefficient of *negative sentiment* is negative and statistically significant (β = -6.913, $p < 0.05$), supporting our baseline hypothesis, i.e., managers' negative sentiment revealed during conference calls is negatively associated with firms' stock market reactions. In H1, we argue that the negative effect of managers' negative sentiment on market reactions will be amplified if the firm has more R&D investments. To test this hypothesis, we included the firm's *R&D intensity* and its interaction term with *negative sentiment* in the model. The results (Model 3 in Table 2) show that the coefficient of *negative sentiment* × *R&D intensity* is negative and statistically significant (β = -0.686, $p < 0.10$), indicating that firms' higher R&D intensity can lead to a stronger negative effect in the focal relationship. Therefore,

Table 1
Descriptive statistics and correlation matrix.

	Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	CARs [-1,1]	0.013	4.402	–																		
2	Negative sentiment	0.045	0.022	−0.04	–																	
3	R&D intensity	5.174	6.416	0.01	−0.07	–																
4	Positive sentiment	0.121	0.029	0.02	−0.11	−0.02	–															
5	Tobin's Q	2.399	1.768	0.04	−0.06	0.19	0.02	–														
6	Leverage	0.352	0.194	−0.02	0.06	−0.28	−0.05	−0.21	–													
7	Cash flow per share	0.376	1.055	0.00	0.00	−0.04	0.02	0.04	0.01	–												
8	Sales turnover	0.590	0.458	0.00	0.01	−0.22	0.03	−0.05	0.17	0.01	–											
9	Firm age	5.416	4.003	0.01	0.03	−0.07	−0.09	−0.04	0.32	0.08	0.00	–										
10	Firm size	7.341	1.061	−0.02	0.01	−0.14	−0.01	−0.15	0.38	0.19	0.23	0.39	–									
11	Tangibility	0.917	0.097	0.00	0.07	−0.11	0.01	−0.11	0.09	0.02	0.13	−0.10	−0.01	–								
12	SOE	0.056	0.230	−0.01	0.06	−0.07	0.00	−0.07	0.13	0.05	0.01	0.10	0.12	0.06	–							
13	Shareholder number	9.819	1.263	0.01	0.01	−0.07	−0.06	−0.14	0.16	−0.02	−0.01	0.47	0.34	−0.06	0.09	–						
14	First shareholder proportion	33.380	14.110	−0.01	0.02	−0.14	0.05	−0.04	0.01	0.04	0.10	−0.13	0.06	0.15	0.31	−0.10	–					
15	CEO age	49.070	6.784	0.02	−0.01	0.02	−0.04	0.01	0.01	0.02	−0.04	0.12	0.05	−0.01	0.04	0.07	−0.01	–				
16	CEO duality	0.362	0.481	0.01	−0.03	0.09	−0.01	0.06	−0.10	−0.02	−0.03	−0.13	−0.09	−0.02	−0.13	−0.10	0.04	0.23	–			
17	CEO gender	0.926	0.261	−0.01	0.03	0.03	0.02	0.00	0.00	0.00	0.01	0.01	0.02	−0.01	0.02	0.00	−0.05	0.03	0.07	–		
18	CEO financial background	0.055	0.229	0.01	0.00	−0.02	0.00	−0.02	0.08	0.04	−0.07	0.05	0.01	−0.01	0.00	0.06	−0.04	−0.03	0.06	−0.04	–	
19	CEO education	3.699	1.381	−0.01	−0.04	0.08	0.02	0.04	0.00	0.01	0.00	0.02	0.06	−0.03	0.02	0.02	−0.03	−0.11	0.03	−0.01	0.01	–
20	Marketization index	12.210	3.448	0.03	−0.13	0.13	−0.01	0.03	0.02	0.03	0.03	0.13	0.06	−0.10	−0.11	0.09	−0.09	0.05	0.09	0.02	0.05	0.02

Note: The number of observations is 10,568.

Table 2
The effect of management's negative sentiment on firms' CARs and the moderating effect of firms' R&D intensity.

	Model 1	Model 2	Model 3
	CARs [-1,1]	CARs [-1,1]	CARs [-1,1]
Negative sentiment		−6.913**	−7.550**
		(3.108)	(3.061)
Positive sentiment	4.866***	4.207***	4.230***
	(1.587)	(1.589)	(1.590)
Negative sentiment × R&D intensity			−0.686*
			(0.412)
R&D intensity	−0.003	−0.003	−0.005
	(0.008)	(0.008)	(0.007)
Tobin's Q	0.135***	0.133***	0.133***
	(0.036)	(0.036)	(0.036)
Leverage	−0.236	−0.219	−0.244
	(0.290)	(0.291)	(0.292)
Cash flow per share	−0.014	−0.014	−0.014
	(0.040)	(0.040)	(0.040)
Sales turnover	0.048	0.044	0.044
	(0.089)	(0.089)	(0.089)
Firm age	−0.005	−0.000	−0.001
	(0.015)	(0.015)	(0.015)
Firm size	−0.053	−0.055	−0.056
	(0.054)	(0.055)	(0.055)
Tangibility	0.192	0.216	0.220
	(0.542)	(0.542)	(0.541)
SOE	−0.099	−0.090	−0.096
	(0.187)	(0.186)	(0.186)
Shareholder number	0.045	0.046	0.044
	(0.049)	(0.049)	(0.049)
First shareholder proportion	−0.004	−0.004	−0.004
	(0.003)	(0.003)	(0.003)
CEO age	0.010	0.010	0.010
	(0.007)	(0.007)	(0.007)
CEO duality	0.027	0.026	0.026
	(0.102)	(0.102)	(0.102)
CEO gender	−0.223	−0.209	−0.205
	(0.175)	(0.175)	(0.175)
CEO financial background	0.179	0.185	0.191
	(0.210)	(0.210)	(0.210)
CEO education	−0.036	−0.039	−0.039
	(0.033)	(0.033)	(0.033)
Marketization index	0.015	0.014	0.014
	(0.015)	(0.015)	(0.015)
Constant	−2.167**	−1.703*	−1.669*
	(0.945)	(0.949)	(0.950)
Observations	10,568	10,568	10,568

Notes: Robust standard errors in parentheses. Year and industry dummies are included. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

H1 is supported. In addition, the coefficient of *negative sentiment* in Model 3 is still negative and statistically significant (β = -7.550, $p <$ 0.05), again supporting our baseline hypothesis.

We also plotted the results to visualize the moderating effects of firms' R&D intensity, as shown in Fig. 2. The *y*-axis represents the stock market reactions to the firm (i.e., CARs), and the *x*-axis represents management's negative sentiment. The increasingly declining pattern indicates that when firms' higher R&D intensity is combined with managers' negative sentiment a stronger negative effect on investors' reactions is evident, which is consistent with our findings for H1.

To examine the investor short-termism effect when investors experience the temporally inconsistent signals sent by firms, we conducted a split sample analysis on firms with different levels of transient institutional ownership and managerial ownership. There are two reasons for our choice of split sample analysis rather than interaction analysis. First, our focus in this research is to explore whether the investor short-termism effect induced by temporally inconsistent signals concentrates in firm-year observations with certain characteristics. Thus, split sample analysis provides a sharp comparison between groups with certain characteristics or elements (e.g., Covin & Slevin, 1988; Deephouse & Carter, 2005; Ketchen & Shook, 1996). Second, using split sample

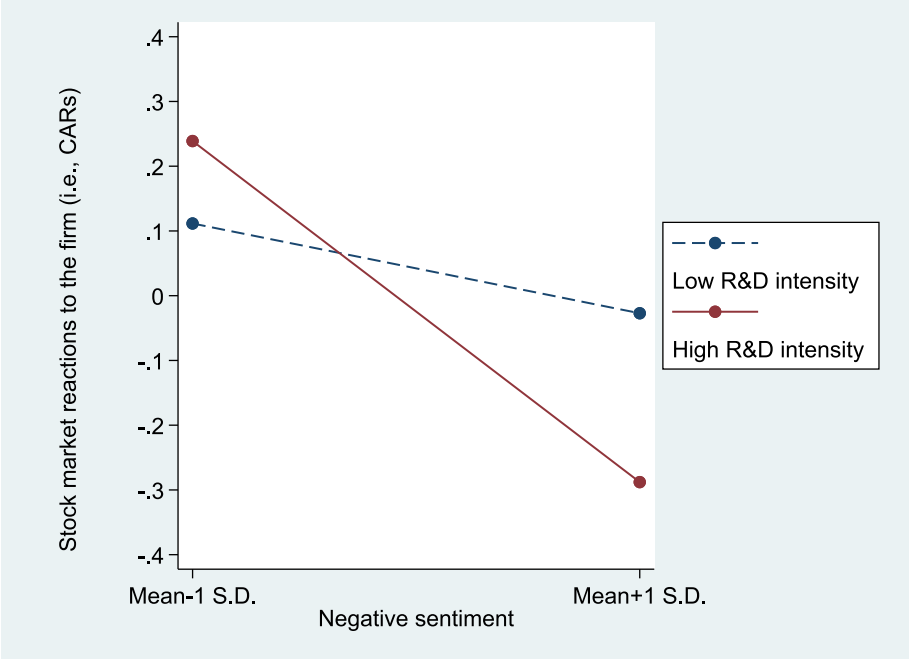

Fig. 2. The moderating effect of firms' R&D intensity.

analysis means that we do not need to include all the two-way interactions to examine whether the interactive effect of managers' negative sentiment and firms' R&D intensity on market reactions is more obvious among certain observations, thus preventing a multicollinearity problem. In addition, the split sample analysis allows full interaction (including the two-way interactions) for every control variable, including fixed effects. Thus, following prior literature (e.g., Ang, Cole, & Lin, 2000; Olavarrieta & Friedmann, 2008; You & Zhang, 2009), we split the sample by the annual median of the transient institutional ownership and the managerial ownership, respectively.

Table 3 and Table 4 report the split sample findings. In H2 we propose that the negative effect of management's negative sentiment toward a firm's status quo on its stock market reaction in the context of the firm's higher R&D intensity will be greater for those firms that have more transient institutional ownership. The results in Table 3 show that the coefficient of *negative sentiment* × *R&D intensity* is negative and statistically significant (β = -0.965, $p < 0.10$) when the transient institutional ownership in a firm is higher, but the coefficient of *negative sentiment* × *R&D intensity* is not statistically significant when the firm has less transient institutional ownership. Moreover, we compared the coefficients of *negative sentiment* × *R&D intensity* between the two groups and found a statistically significant difference ($p < 0.05$). We plotted the moderating effect of firms' R&D intensity for the higher and lower transient institutional ownership groups, as shown in Fig. 3.

H3 argues that the negative effect of management's negative sentiment toward a firm's status quo on market reaction in the context of the firm's higher R&D intensity will be greater for firms that have less managerial ownership. The results in Table 4 show that the coefficient of *negative sentiment* × *R&D intensity* is negative and statistically significant (β = -1.148, $p < 0.05$) when the managerial ownership is lower, but the coefficient of *negative sentiment* × *R&D intensity* is not statistically significant when managers have more ownership of the firm. We also found a statistically significant difference between the coefficients of *negative sentiment* × *R&D intensity* in the two samples ($p < 0.05$). We plotted the moderating effect of firms' R&D intensity for the higher and lower managerial ownership groups, as shown in Fig. 4.

Taken together, the sharp contrast of results in all split sample analyses demonstrates that the investor short-termism effect does exist when investors face the temporally inconsistent signals sent by firms during the corporate communications process, thus inducing stronger negative stock market reactions.

4.2. Additional analyses

Our main analysis relies on the control variables and the industry- and year-fixed effects to mitigate the influence of potential confounding factors. However, our method may fail to address the identification concerns that arise from unobservable time-varying firm characteristics that could drive a spurious relationship between variables of interest and the dependent variable. Thus, we conduct several analyses to address the potential endogeneity issue in our study.

ITCV test. We follow Frank (2000) and Larcker and Rusticus (2010) by implementing the impact threshold confounding variable (ITCV) method to assess the possibility of correlated omitted variables bias because of the nature of our secondary data. Recently, this method has been proposed to quantify the effect of omitted variables bias in management research (Busenbark, Yoon, Gamache, & Withers, 2021). It helps us estimate how strongly an omitted variable would have to be correlated with management's negative sentiment and stock market reactions to render the coefficient of management's negative sentiment reported in the primary results statistically insignificant. We compare the impact threshold with the impact estimates for the control variables to assess whether confounding variables with these minimum partial correlations might exist.

The results of the analysis, shown in Table 5, indicate that the impact threshold (i.e., the value a potential confounding variable must have to invalidate our inferences) is 0.0063 (absolute value) at the 10 % level. The marketization index and managers' positive sentiment are the control variables with the highest raw impact score (−0.0032) and partial impact score (−0.0026), respectively. These results confirm that both the raw impact score of the marketization index and partial impact score of positive sentiment are well below the impact threshold of 0.0063. Given the comprehensive list of control variables included in our estimations, the presence of a confounding variable that renders the managers' negative sentiment coefficient in primary results insignificant is unlikely, indicating that the basic results are robust to omitted variable concerns.

Heckman model. To address the concern that management sentiment

Table 3
The heterogeneous effect of temporally inconsistent signals under higher and lower transient institutional ownership.

	Transient institutional ownership	
	High (above median)	Low (below median)
	Model 1 CARs [-1,1]	Model 2 CARs [-1,1]
Negative sentiment	−1.537	−16.054***
	(2.762)	(3.552)
Positive sentiment	2.020	5.095**
	(2.254)	(2.319)
R&D intensity	−0.007	−0.008
	(0.008)	(0.013)
Negative sentiment × R&D intensity	−0.965*	−0.608
	(0.513)	(0.728)
Long-term institutional ownership	2.324	−4.795*
	(2.167)	(2.699)
Tobin's Q	0.151***	0.109*
	(0.047)	(0.060)
Leverage	−0.294	−0.230
	(0.422)	(0.415)
Cash flow per share	−0.068	0.090
	(0.055)	(0.070)
Sales turnover	0.265**	−0.134
	(0.104)	(0.141)
Firm age	−0.021	0.014
	(0.019)	(0.022)
Firm size	−0.036	−0.060
	(0.079)	(0.082)
Tangibility	0.084	0.202
	(0.708)	(0.889)
SOE	0.158	−0.278
	(0.287)	(0.257)
Shareholder number	0.039	0.075
	(0.066)	(0.076)
First shareholder proportion	−0.007	−0.001
	(0.005)	(0.005)
CEO age	0.001	0.018*
	(0.010)	(0.009)
CEO duality	0.040	0.035
	(0.146)	(0.148)
CEO gender	−0.086	−0.326
	(0.257)	(0.248)
CEO financial background	0.077	0.308
	(0.302)	(0.276)
CEO education	−0.032	−0.055
	(0.045)	(0.047)
Marketization index	0.035*	−0.004
	(0.020)	(0.021)
Constant	−1.155	−2.324
	(1.307)	(1.441)
Observations	5281	5287
Difference between coefficients of negative sentiment × R&D intensity	$p < 0.05$	

Notes: There are two reasons why we use split sample analysis rather than interaction analysis. (1) Our focus is on exploring whether the investor short-termism effect induced by temporally inconsistent signals concentrates in firm-year observations with certain characteristics. Thus, split sample analyses provide a sharp comparison between groups with certain characteristics. (2) By using split sample analysis, we do not need to include all the two-way interactions, thus preventing a multicollinearity problem. In addition, the split sample analysis allows full interaction (including the two-way interactions) of every control variable, including fixed effects. In this sense, it is superior to interaction analyses. Robust standard errors in parentheses. Year and industry dummies are included. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4
The heterogeneous effect of temporally inconsistent signals under higher and lower managerial ownership.

	Managerial ownership	
	High (above median)	Low (below median)
	Model 1 CARs [-1,1]	Model 2 CARs [-1,1]
Negative sentiment	−3.418	−13.239***
	(4.061)	(3.080)
Positive sentiment	3.723	5.000**
	(2.472)	(2.028)
R&D intensity	−0.002	−0.008
	(0.013)	(0.009)
Negative sentiment × R&D intensity	−0.651	−1.148**
	(0.644)	(0.546)
Tobin's Q	0.170***	0.093**
	(0.054)	(0.047)
Leverage	−0.446	−0.033
	(0.482)	(0.376)
Cash flow per share	0.100	−0.062
	(0.088)	(0.047)
Sales turnover	−0.003	0.033
	(0.144)	(0.110)
Firm age	−0.015	0.018
	(0.028)	(0.018)
Firm size	−0.055	−0.052
	(0.088)	(0.072)
Tangibility	−0.162	0.565
	(0.792)	(0.714)
SOE	0.588	−0.212
	(1.218)	(0.196)
Shareholder number	0.058	0.018
	(0.071)	(0.070)
First shareholder proportion	−0.008	−0.000
	(0.006)	(0.004)
CEO age	0.008	0.014
	(0.010)	(0.010)
CEO duality	−0.163	0.227
	(0.142)	(0.150)
CEO gender	−0.207	−0.146
	(0.243)	(0.244)
CEO financial background	0.060	0.259
	(0.319)	(0.258)
CEO education	−0.013	−0.062
	(0.046)	(0.046)
Marketization index	0.017	0.014
	(0.023)	(0.019)
Constant	0.066	−1.865
	(1.438)	(1.253)
Observations	5024	5544
Difference between coefficients of negative sentiment × R&D intensity	$p < 0.05$	

Notes: There are two reasons why we use split sample analysis rather than interaction analysis. (1) Our focus is on exploring whether the investor short-termism effect induced by temporally inconsistent signals concentrates in firm-year observations with certain characteristics. Thus, split sample analyses provide a sharp comparison between groups with certain characteristics. (2) By using split sample analysis, we do not need to include all the two-way interactions, thus preventing a multicollinearity problem. In addition, the split sample analysis allows full interaction (including the two-way interactions) of every control variable, including fixed effects. In this sense, it is superior to interaction analyses. Robust standard errors in parentheses. Year and industry dummies are included. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

revealed during the conference call is not a random treatment variable and that the causality relationship in our primary results is biased, we employ a Heckman two-stage-model analysis to test the potential selection biases and estimate our coefficients (Greene, 2008; Heckman, 1979). Specifically, we estimate a probit model in the first stage, and show the probability of a negative sentiment expressed by managers on the conference call. Then, we include the Air Quality Index (AQI) of the city where the firm is located on the conference call date as an instrumental variable in the first-stage model. Prior research in health science and behavioral finance argues that air pollution negatively affects humans' cognition and mood by increasing the risk of depression and even inducing behavioral bias, such as decreasing analysts' earnings forecasts (Block & Calderón-Garcidueñas, 2009; Dong, Fisman, Wang, & Xu, 2021; Huang, Xu, & Yu, 2020).

Notably, in our context, managers usually hold conference calls

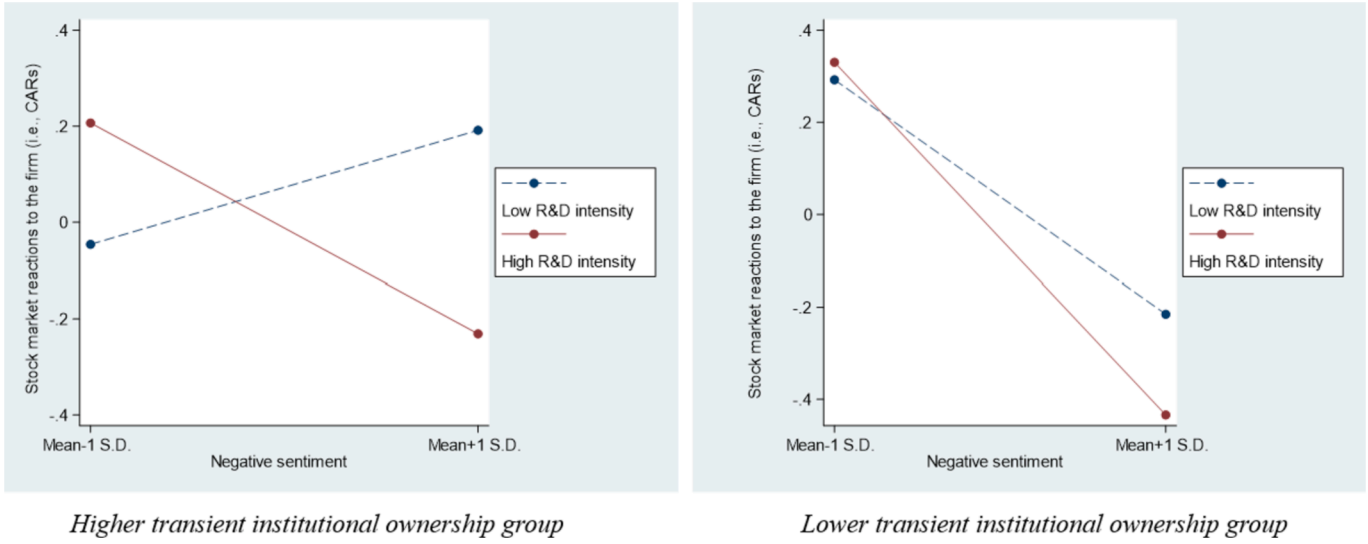

Fig. 3. The moderating effect of firms' R&D intensity for higher and lower transient institutional ownership groups.

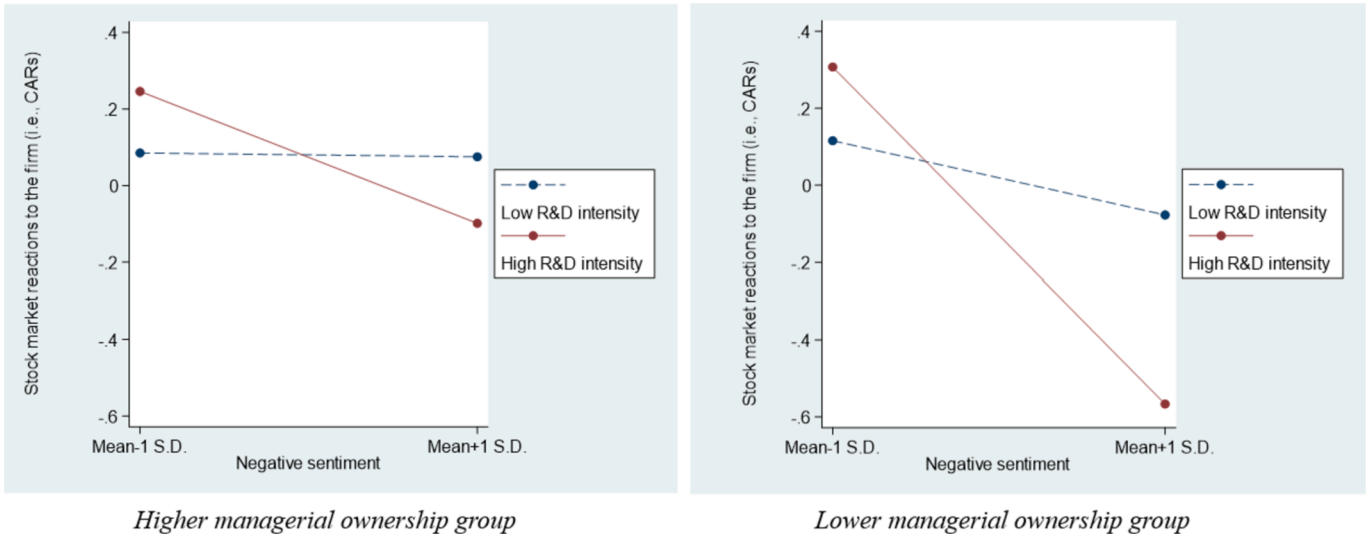

Fig. 4. The moderating effect of firms' R&D intensity for higher and lower managerial ownership groups.

online and offline synchronously in the city where the firm is located because of the popularity of electronic communication techniques. Except for a small number of investors who come to the physical location, most investors communicate with managers through the online platform. Therefore, while the air quality in the city where the firm is located is likely to correlate with managers' sentiments to a great extent, it is unlikely to affect the evaluations of most investors, as these investors are largely located out of the city; this indicates that city air quality can serve as a suitable instrument. We obtained daily observations of AQI for each city, available online, and in the air quality report published by the Ministry of Environmental Protection of China. The city's AQI is constructed based on various atmospheric pollutants each day (such as SO_2, NO_2, $PM_{2.5}$, etc.), and ranges from 0 to 500, with a larger value indicating poorer air quality (Dong et al., 2021; Huang et al., 2020; Li, Massa, Zhang, & Zhang, 2021).

Then, we estimate the probit model and calculate the inverse Mills ratio (IMR) from the first-stage estimation. Together with all control variables used in the first stage, we include IMR and key predictors in the second stage to correct for self-selection bias and to examine our hypotheses. The results of the Heckman two-stage-model analysis are presented in Table 6. In the first-stage selection model, the coefficient of the instrumental variable, AQI, is positive and significant ($\beta = 0.6925$, $p < 0.10$), which is consistent with our prediction that poorer air quality (measured by higher AQI) in the city where the firm is located on the conference call day is positively correlated with management's negative sentiment. Model 2 indicates that management's negative sentiment during the conference call is still negatively associated with investors' market reactions ($\beta = -0.1047$, $p < 0.01$). Furthermore, Model 3 offers evidence that a firm's higher R&D intensity strengthens the negative relationship between management's negative sentiment and stock market reactions to the firm ($\beta = -0.0141$, $p < 0.01$). In sum, this test allows us to rule out the possibility of potential endogeneity issues that would bias the relationship in the primary analysis to some extent.

Taken together, the additional tests above exhibit overall consistency with the primary analysis, indicating that our key results are robust.

5. Discussion

Centering on the literature on inconsistent signals and cognitive dissonance, we question how investors evaluate firms when they receive inconsistent signals with different temporal orientations (i.e., short-term oriented information on firms' status quo versus long-term oriented

Table 5
Impact threshold confounding variable (ITCV) analysis.

	Impact threshold (absolute value)	Implied minimum correlations (absolute value)	ρ (X, Manager's negative sentiment)	ρ (X, Stock market reaction)	Impact raw	ρ (X, Manager's negative sentiment | Z)	ρ (X, Stock market reaction | Z)	Impact partial
Negative sentiment	0.0063	0.0800						
Leverage			0.0561	−0.0160	−0.0009	0.0258	−0.008	−0.0002
Firm age			0.0329	0.0104	0.0003	0.0351	0.0111	0.0004
Sales turnover			0.0114	−0.0036	0.0000	0.0076	0.0031	0.0000
Tangibility			0.0699	0.0000	0.0000	0.0489	0.0089	0.0004
Firm size			0.0089	−0.0152	−0.0001	−0.0158	−0.0138	0.0002
Tobin's Q			−0.0622	0.0394	−0.0024	−0.0412	0.0353	−0.0015
Cash flow per share			−0.0034	0.0042	0.0000	0.0013	0.0035	0.0000
SOE			0.0594	−0.0105	−0.0006	0.0306	−0.0033	−0.0001
Shareholder number			0.0099	0.0056	0.0001	−0.0074	0.0083	−0.0001
First shareholder proportion			0.0237	−0.0113	−0.0003	0.0042	−0.0058	0.0000
Marketization index			−0.1282	0.0248	−0.0032	−0.1216	0.0208	−0.0025
Manager's positive sentiment			−0.1081	0.0221	−0.0024	−0.1067	0.0239	−0.0026
CEO age			−0.0073	0.0210	−0.0002	−0.0124	0.0175	−0.0002
CEO gender			0.0260	−0.0130	−0.0003	0.0315	−0.0139	−0.0004
CEO duality			−0.0321	0.0079	−0.0003	−0.0061	0.0009	0.0000
CEO education			−0.0439	−0.0111	0.0005	−0.0375	−0.0108	0.0004
CEO financial background			0.0002	0.0113	0.0000	0.0057	0.0103	0.0001

Notes: This table presents results for ITCV analyses, which estimate how strongly an omitted variable would have to be correlated with the managers' negative sentiment and stock market reaction variables to render the coefficient of managers' negative sentiment in the primary results insignificant at the 10 percent level, two-tailed. Impact threshold (in column 1) is the impact a confounding variable would have to invalidate inferences from Model 2 of Table 2. Implied minimum correlations (in column 2) are the minimum correlations a confounding variable must have with both managers' negative sentiment (the independent variable) and stock market reaction (the dependent variable) to render the coefficient of managers' negative sentiment insignificant. Columns 3 and 4 report the Pearson correlations between a control variable (denoted X) and managers' negative sentiment and stock market reaction, respectively. Impact raw is the product of the Pearson correlations reported in columns 3 and 4. Columns 6, 7, and 8 are similarly calculated after partialling out the effect of all other control variables (denoted Z), including year and industry fixed effects. According to our analysis, an omitted variable would have to be correlated at 0.080 with the stock market reaction and at −0.080 with managers' negative sentiment (signs are interchangeable), and correspondingly the impact of an omitted variable must be 0.0063 to invalidate our inference. These thresholds can be compared with the impacts of observed covariates respectively to assess the possibility of correlated omitted variables bias.

information on firms' prospects). Using the setting and panel data of public firms in China, we firstly find that managers' negative sentiment toward a firm's status quo is negatively associated with its market reaction. This finding is consistent with the key arguments asserting the primary importance of management's positive or negative sentiment on investors' assessment in existing literature (e.g., Henry, 2008; Jegadeesh & Wu, 2013; Jiang et al., 2019; MacGregor et al., 2000).

More importantly, we highlight the effect of temporally inconsistent signals on stock market reaction by arguing that the sentiment expressed by managers about a firm's status quo explains only a small portion of the variance in audience reactions to signals. Our results imply that a firm's higher R&D intensity strengthens the negative effect of managers' negative sentiment toward the firm's status quo on its market reaction. These findings extend our understanding of the direct linkage between management's sentiment and investors' market reactions (Davis & Tama-Sweet, 2012; Feldman et al., 2010; Huang, Teoh, & Zhang, 2014) by examining this linkage through a temporal lens. The results suggest that firms' investments in R&D activities subsequently frame investors' assessment, and that investors' evaluations of R&D investments also depend on additional signals, such as managers' sentiment toward firms' status quo. The trade-off setting of different temporally oriented signals also helps us to move beyond the implicit assumption of inconsistent signals along the same temporal dimensions in prior research and provides novel insights into signaling theory literature.

In addition, focusing on the firm's ownership structure (Boyd & Solarino, 2016), we find that the detrimental effect of temporally inconsistent signals on market reactions is stronger when a firm has higher transient institutional ownership and lower managerial ownership. As such, we show the presence of an investor short-termism effect and add new evidence about the contingent effects of firms having different ownership structures when investors interpret inconsistent signals with different temporal orientations. These findings about the boundary conditions also respond to the call for more investigation of firms' ownership within a comprehensive model (Connelly, Hoskisson, Tihanyi, & Certo, 2010) and complement existing ownership structure studies.

6. Theoretical contributions

This study contributes to the literature on how audiences respond to temporally inconsistent signals during the corporate communication process. First, we complement the research on signal inconsistency within the signaling theory literature (Connelly et al., 2011; Connelly et al., 2024; Paruchuri et al., 2021; Vergne et al., 2018). As we have already noted, while there has been fruitful research on how investors evaluate a firm when they receive inconsistent signals disclosed by the firm, most of the research has held the implicit assumption that inconsistent signals exist along the same temporal dimensions. However, signal inconsistency often appears across different temporal orientations. Under such circumstances, it is valuable to ascertain how audiences perceive such temporal incongruence and their subsequent investment decisions in light of these perceptions. Therefore, we challenge the prior assumption in signaling theory that signal inconsistency only occurs within the same temporal dimension (Drover et al., 2018: 225), and examine how investors evaluate a firm that conveys inconsistencies between the firm's short-term signals about its status quo and long-term signals about its prospects. By doing so, we contribute to the signaling theory literature by deepening understanding from a

Table 6
Heckman two-stage-model estimation.

	Model 1	Model 2	Model 3
	Negative sentiment	CARs [-1,1]	CARs [-1,1]
AQI	0.6925*		
	(0.3979)		
Positive sentiment	−3.8508***	0.1502**	0.1503**
	(0.5696)	(0.0690)	(0.0689)
Tobin's Q	−0.0234**	0.0022***	0.0022***
	(0.0112)	(0.0006)	(0.0006)
Leverage	0.2360*	−0.0065	−0.0068
	(0.1256)	(0.0055)	(0.0055)
Cash flow per share	0.0165	−0.0004	−0.0004
	(0.0129)	(0.0006)	(0.0006)
Sales turnover	−0.0580	0.0028**	0.0028**
	(0.0417)	(0.0014)	(0.0014)
Firm age	0.0239***	−0.0005	−0.0005
	(0.0059)	(0.0004)	(0.0004)
Firm size	−0.0365	0.0003	0.0003
	(0.0285)	(0.0010)	(0.0010)
Tangibility	0.2680	−0.0071	−0.0071
	(0.1638)	(0.0072)	(0.0072)
SOE	0.1606*	−0.0046	−0.0047
	(0.0850)	(0.0037)	(0.0037)
Shareholder number	0.0013	0.0004	0.0004
	(0.0169)	(0.0008)	(0.0008)
First shareholder proportion	−0.0014	0.0000	0.0000
	(0.0014)	(0.0001)	(0.0001)
CEO age	0.0031	−0.0000	−0.0000
	(0.0028)	(0.0001)	(0.0001)
CEO duality	−0.0303	−0.0001	−0.0002
	(0.0359)	(0.0015)	(0.0015)
CEO gender	0.0544	−0.0053**	−0.0052**
	(0.0775)	(0.0025)	(0.0025)
CEO financial background	0.0752	−0.0013	−0.0013
	(0.0774)	(0.0028)	(0.0028)
CEO education	−0.0385***	0.0003	0.0003
	(0.0138)	(0.0008)	(0.0008)
Marketization index	0.0062	0.0001	0.0001
	(0.0057)	(0.0002)	(0.0002)
Negative sentiment		−0.1047***	−0.0989***
		(0.0316)	(0.0314)
R&D intensity		−0.0000	−0.0001
		(0.0001)	(0.0001)
Inverse Mills ratio		−0.0395	−0.0394
		(0.0240)	(0.0240)
Negative sentiment × R&D intensity			−0.0141***
			(0.0049)
Constant	0.2867	0.0134	0.0131
	(0.3714)	(0.0189)	(0.0189)
Observations	6680	6680	6680

Notes: AQI denotes the Air Quality Index of the city where the firm is located on the conference call day, scaled by 1000 to better interpret the regression coefficients. The standard errors are clustered at the city level in Model 1. Robust standard errors in parentheses in Model 2 and Model 3. Year and industry dummies are included in all models. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

temporal perspective of investors' more holistic evaluation of a firm based on its conveyed signals (Drover et al., 2018: 225; Paruchuri et al., 2021).

Second, the study contributes to the literature on cognitive dissonance by showing how individuals seek to reduce cognitive dissonance when receiving contradictory signals with different temporal orientations. Drawing on insights from cognitive dissonance theory (Festinger, 1957; Hinojosa et al., 2016), we highlight the cognitive foundation for investors' assessment of inconsistencies in signals with different temporal orientations, and provide a comprehensive picture of investors' interpretations of firms' long-term oriented investments together with management's sentiment toward the firm's present situation. By investigating how receivers resolve the uncomfortable psychological state caused by inconsistency across short-term and long-term oriented signals, our research responds to the recent call for integrating a cognitive perspective into information processing (Drover et al., 2018) and joins the dialogue on how receivers evaluate the tensions created by multiple signals (e.g., Miyazaki et al., 2005; Tan, Wang, & Zhou, 2015; Wang & Choi, 2010; Zhang et al., 2022).

Finally, we enrich the R&D investment literature by highlighting the potential adversary effect such investment may have on market reaction. From a conventional point of view, a firm's dedication to long-term development, such as engaging in corporate social responsibility (CSR) or R&D initiatives, has been considered likely to positively affect the market evaluation of the firm (Papa et al., 2022). Therefore, firms tend to manage their relationships with investors and stakeholders by engaging in long-term activities and socially responsible programs (Cheng, Ioannou, & Serafeim, 2014; Flammer & Ioannou, 2021). However, recent research indicates that these investments may not always play a positive role, and may even induce negative effects in some cases. For example, Hubbard, Christensen and Graffin (2017) show that prior investments in CSR appear to expose CEOs of firms with poor financial performance to a greater risk of dismissal. In this study, we found that when investors receive negative signals about a firm's present performance, long-term oriented signals about the firm's greater R&D investments become a catalyst that further fuels the investors' negative evaluations of the firm. Therefore, our research not only responds to the call for more investigation into the potential dark side, in some circumstances, of intensified long-term oriented investments (e.g., Gond, El Akremi, Swaen, & Babu, 2017), but also provides novel evidence that extends prior studies by illustrating the potential adversary effect of R&D investments in the context of corporate communication.

6.1. Managerial implications

Our paper has important implications for management practices, investors' decisions and government policies. From the standpoint of firms (i.e., signal senders), we remind managers of the tension between management signals across different temporal dimensions, and shed light on the effects of managers' disclosure strategies on investors' judgments. Prior research has indicated that managers can positively influence investor perception by sharing their long-term strategies (Merkley, 2014). For instance, Papa et al. (2022) suggest that firms' knowledge-intensive activities, such as R&D investment and innovation, are often viewed as important to sustain competitive advantage. However, we argue that this favorable effect on perception might not persist if managers express pessimism about their company's current status. For managers aiming to reduce information asymmetry and paint a promising future through long-term strategy disclosures, our findings hold particular importance. In particular, managers need to pay more attention to the potential punitive effect of firms' heavy R&D investments on investors' evaluations when managers publicly express negative sentiment toward the firm's status quo. When communicating with audiences, firms should be aware of the unintended consequences that inconsistencies in signals with different temporal orientations can bring; the gospel of disclosing somewhat positive information with high uncertainty may become a curse under some circumstances. In this vein, our findings are in line with prior research that suggests firms enhancing implicit information sharing to enhance trust and efficient communication (Chen & Huan, 2020). However, it should be noted that our arguments do not suggest that long-term investment *per se* is bad and that firms should refrain from R&D efforts because of the potential adversary effect. As theorized, we propose that the stronger negative market reactions unfold as the result of investors seeking a means to reconcile cognitive dissonance. Hence, we suggest that managers should explore how the skepticism and contradictions generated in these circumstances can be reasonably addressed in practice (e.g., through more thorough management explanations to boost investors' confidence).

From the standpoint of the audiences (i.e., signal receivers), we suggest investors evaluate a firm's prospects according to wider range of

signals. Firms often disclose information through various channels, such as content prepared in advance (e.g., annual report, CSR report) and more spontaneous oral expressions or emotions conveyed at conference calls or through media (see, for example, De Luca, Iaia, Mehmood, & Vrontis, 2022). Faced with asymmetric information, investors should be vigilant about their perceptions when a firm discloses that it has invested heavily in long-term oriented activities and its managers express negative sentiments through other channels. Moreover, investors should be aware of the presence of cognitive dissonance when evaluating a firm by interpreting temporally inconsistent signals. Although firms' existing R&D investments may provide returns for investors in the long run, the investors tend to exhibit a short-termism effect in response to managers' negative sentiment toward the firm's status quo. Therefore, we posit that the evaluation of the potential of a firm's long-term oriented investment should be based on multiple signals, such as analysts' ratings, industry development, national policy, and so on. We suggest investors should use different information to comprehensively evaluate the prospects of a firm rather than opting to reduce cognitive dissonance based on only limited information disclosed by firms. A more comprehensive evaluation would help investors make a more rational assessment of signals in the course of investment decision-making.

Moreover, we also recommend that relevant government agencies and regulators should increase the transparency of the information disclosure environment to deal with the inconsistent signals across temporal orientations in the management–investor communication process. As scholars have acknowledged, both firms and investors exist in an environment with information asymmetry (e.g., Alinasab et al., 2022; Chen & Huan, 2020), and the inconsistencies across signals along different temporal dimensions can exert a large impact on investment decisions, and thus can drive fluctuations in the stock market. Therefore, regulatory authorities have a responsibility to create a transparent environment for information disclosure. Such an environment is not only useful for decreasing the potential punitive effect on public firms of temporally inconsistent signals, but also makes investors aware of the cognitive dissonance that emerges when incongruent signals across different temporal orientations are sent. Specifically, we suggest regulators issue appropriate policies or construct more platforms (e.g., offline and online channels) for managers and investors to effectively communicate information about firms' status quo and development potential. In addition, relevant authorities could provide investors with consultation and guidance to deepen their understanding of the impact of the temporal dimension of signals on decision-making. The joint efforts of government and other parties could highlight the primary elements that have been neglected in practice in the past—i.e., signal inconsistencies across different temporal orientations—so as to protect the interests of investors and promote the development of the capital market.

6.2. Limitations and future research

As with all studies, ours has limitations that suggest future research avenues. First, we find that firms' greater long-term oriented investments in R&D activities can amplify the detrimental effect of management's negative sentiment on market reactions. However, it should be noted that our arguments do not suggest that firms should avoid R&D efforts because of the potential adversary effect. In particular, we want to send the message that the short-termism effect is salient when investors face temporally inconsistent signals in the corporate communications process. While we remind managers of the skewing effects of long-term oriented investments together with negative sentiment on investors' judgments, we did not empirically examine how firms can reconcile the dissonance experienced by investors to avoid negative stock market reactions. Future studies may further explore effective tools or methods that can be used by managers to decrease investors' cognitive dissonance under inconsistent signals across different temporal dimensions.

Second, we conducted our research in the context of public firms in China. The Chinese capital market and the firm conference calls setting provide an ideal environment to examine how less sophisticated investors respond to inconsistent signals with different temporal orientations. One reason for this is that China's capital market is not as mature as those in developed countries and exhibits low transparency and high volatility (e.g., Ho, Yang, & Luo, 2022). Information asymmetries are particularly salient because audiences have incomplete access to details on firms' operations, and investors are less sophisticated in interpreting signals comprehensively. Moreover, one challenge evident in the existing literature concerned with understanding investors' reaction to firms' signals in emerging markets is that firms' disclosures are not always available. The availability of data about the information disclosed by managers on conference calls in China creates an ideal setting for us to understand investors' immediate reactions toward firm disclosures in an emerging market.

Although we have only examined the issue in the Chinese context, we believe that the phenomenon is universal, especially for other emerging capital markets with substantial information asymmetry. In addition, cognitive dissonance is a very common psychological state among individuals. Thus, we predict that the key logic and conclusions in our research can apply to other scenarios as well. It would be also interesting to clarify some contextual factors, such as cultural differences in temporal orientations, institutional environment, distinctiveness of the capital market, and so on. However, we did not test our hypotheses empirically with data from the global capital market. We hope future studies may examine whether, and if so how, audiences interpret inconsistency across short-term and long-term oriented signals in different ways in different settings (e.g., comparing a developed capital market with an emerging/underdeveloped capital market). This work may help clarify the boundary conditions of our results and the extent to which what we found might change in other contexts.

Finally, our empirical analyses were based on the secondary data of public firms' conference calls. It is important to delve deeper into the cognitive mechanisms of individuals' interpretation of multiple signals, especially when receivers deal with temporally inconsistent signals. Therefore, we encourage future studies to open the black box of receivers' cognitions through scenario experiments, in-depth interviews, case studies, or other suitable methods to help us better understand the actors' decision-making process.

7. Conclusion

We show how investors evaluate a firm when confronted with inconsistent signals between a firm's status quo in the short term and its prospects in the long run. Our theory and findings indicate that the inconsistency between short-term and long-term oriented signals induces cognitive dissonance among investors, leading them to make risk-averse decisions to resolve this psychological discomfort. Consequently, the adverse effect of managers' negative sentiment on market reactions is amplified when a firm's R&D investment level is high. By incorporating signaling theory and the literature on cognitive dissonance, we challenge the assumption in signaling theory that inconsistency only occurs within the same temporal dimension and we respond to calls in the literature for more investigation from a cognitive perspective on investors' interpretations of multiple signals disclosed by firms. More generally, our findings can also extend to the common phenomenon that managers' sentiment toward a firm's status quo may act as a key reference point for investors to evaluate the firm's long-term oriented investments (not just limited to R&D investments) and the firm's potential for generating profits in the future. Our study serves as just a primary step forward in that regard. The inconsistencies among other kinds of signals with short-term and long-term orientations and the complex process of interpretations of temporally inconsistent signals deserve to be explored in detail within the signaling literature. Overall, the study highlights the significant role of temporally inconsistent

signals both in theory and practice. We hope future studies will further explore the insights generated by this study to complement our understanding of signal inconsistencies with different temporal dimensions and the variations that may occur in different settings.

CRediT authorship contribution statement

Maogang Sun: Writing – original draft, Methodology, Investigation, Formal analysis. **Zhengyu Li:** Writing – review & editing, Supervision, Resources, Project administration, Funding acquisition, Conceptualization. **Lu Yang:** Validation, Supervision, Software, Methodology.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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