Stock Price Crash Risk and the Managerial Rhetoric Mechanism: Evidence from R&D Narrative Disclosure in 10-K filings

Panayiotis C. Andreou*†
Neophytos Lambertides*
Marina Magidou‡

January 2025

Abstract

We operationalize managerial rhetoric by utilizing narrative disclosure of forward-looking R&D activities in the MD&A section of 10-K filings. Using ChatGPT, we demonstrate that this managerial rhetoric is contextually relevant and aligns with cues indicative of investor optimism. The empirical tests show that managerial rhetoric is positively associated with future idiosyncratic stock price crashes. This association is pronounced in firms facing high competition, lower entrenchment, and covered by analysts. Intriguingly, stronger internal corporate governance does not mitigate the managerial rhetoric-crash relation. This study identifies cheap talk by linking positive changes in R&D narrative disclosures to stock price crash risk, revealing that such rhetoric, when unsubstantiated, is negatively associated with future patent outputs. Our findings underscore the existence of a mechanism that managers exploit to hype investors' expectations and inflate stock prices.

Keywords: Stock price crash risk; Managerial rhetoric mechanism; Narrative disclosure; Textual analysis; 10-K filings; Research and development; Agency theory; Corporate governance
JEL Classification: G12; G30; G32; D83.

*Cyprus University of Technology, Department of Finance, Accounting and Management Science, Archbishop Kyprianou 30, Limassol 3603, Cyprus.
†Durham University, Durham University Business School, Mill Hill Lane, Durham, DH1 3LB, United Kingdom.
‡Open University of Cyprus, Faculty of Economics and Management, Yiannou Kranidioti Avenue, Nicosia 2220, Cyprus
E-mail addresses: panayiotis.andreou@cut.ac.cy, n.lambertides@cut.ac.cy, marina.magidou@ouc.ac.cy

1 Introduction

The literature on stock price crash risk has undergone substantial development over the past two decades, whilst the investigation into the relation between crashes and their determinants remains a burgeoning field of study. This body of work builds on the seminal studies of Jin and Myers (2006), Hutton, Marcus, and Tehranian (2009), Kothari, Shu, and Wysocki (2009) and Benmelech, Kandel, and Veronesi (2010), which theorize the existence of a *bad news hoarding mechanism* to explain idiosyncratic stock price crashes. Accordingly, these crashes stem from agency problems, either because managers engage in earnings management to make their firms more opaque, or because they overinvest to pretend the continued flourishing of their firms' growth opportunities. In either case, self-interested managers take advantage of information asymmetries to strategically withhold bad news, aiming to pursue short-term price maximization at the expense of shareholders. However, recent empirical evidence by Andreou, Lambertides, and Magidou (2023) puts under dispute the managers' ability to persistently hoard bad news through systematic earnings management and overinvestment practices, especially in the post Sarbanes-Oxley Act period.

Our study advances the crash risk literature by introducing a novel concept, namely, the *managerial rhetoric mechanism*. We view this mechanism as an important narrative conduit through which managers disseminate information, often strategically utilized to portray a more optimistic outlook of their firms' future prospects. This view resonates with the notion that "narratives enable people to make sense of their environments by providing simple mental models of causal relations that focus their attention on particular variables and lead them to make particular predictions" (Akerlof and Snower, 2016, p. 70). Further, studies document that managers tend to engage in fluff narrative disclosure, or cheap talk, regarding their firm's prospects (Dimitrov and Jain, 2011; Balvers, Gaski, and McDonald, 2016; Yekini, Wisniewski, and Millo, 2016; Bushee, Taylor, and Zhu, 2022). In this context, managers can hype expectations by leveraging the inherent dynamism of storytelling, especially when narrating uncertain and difficult-to-verify outcomes they anticipate happening in the future.

This behavior can lead to unjustifiably high investor expectations and inflate a firm's stock price beyond its intrinsic value for prolonged periods. When these inflated expectations are not met, investors may abruptly downgrade their assessment of the firm's actual economic value, ultimately triggering an idiosyncratic stock price crash.

Corporate communication has long been conducted through the lens of narratives and storytelling (Akerlof and Snower, 2016; Shiller, 2017; Michalopoulos and Xue, 2021). Narratives exert significant power over investors and have in fact increased in the information age (Shiller, 2020). The narratological concepts employed in qualitative texts can be, if not more, equally informative as quantitative data. Empirical evidence lends support to the hypothesis that "soft" qualitative information−conveyed by linguistic content communication in managerial narrative−is incrementally useful to quantitative information in predicting future firm fundamentals (Mayew and Venkatachalam, 2012). If anything, managerial narrative disclosure in public reports, like a firm's 10-K filings, can bridge the gap between a firm's financial statement numbers and its underlying business fundamentals (Merkley, 2014; Bryan, 1997; Li, 2010; Muslu, Radhakrishnan, Subramanyam, and Lim, 2015).

Rhetoric signifies a powerful tool in narratives, enabling the formulation of compelling stories that can be used for either good or bad purposes. As the Greek philosopher Aristotle argued, *rhetoric is the art of obtaining all the available means to persuade others.* The rhetorical devices of persuasion consist of employing convincing language and techniques to engage the audience, evoke emotions, and guide their understanding of the story being told (Kallendorf and Kallendorf, 1985). In his book "Narrative economics: How stories go viral and drive major economic events," Robert Shiller emphasizes the power of narratives, detailing how they can shape people's perceptions and propagate rapidly among the public (Shiller, 2020). According to Shiller, narratives don't merely convey facts; they can be leveraged as vehicles for rhetorical strategies with the objective to influence people's beliefs, emotions, and actively shape decision-making in the economic domain. Whilst his work does not directly pertain to rhetoric, the themes that Shiller (2020) investigates illustrate how

narratives in economics can be strategically constructed to persuade, inform public opinion, and exert influence on financial decisions at a large scale.

It remains unexplored whether the power of rhetoric, facilitated through narrative disclosures in public reports such as the Management's Discussion and Analysis (MD&A) section in 10-K filings, can be utilized as a communication channel for managerial "cheap talk" intended to foster investor optimism. MD&A is an important tool that enables managers to convey "soft" qualitative information to stakeholders, making this section valuable for forecasting a firm's future prospects (Davis, Piger, and Sedor, 2012; Li, 2008; Kim and Park, 2012; Mayew and Venkatachalam, 2012; Li, 2019). Managerial narrative disclosure in MD&A is not subject to explicit disclosure rules, thus allowing executives significant leeway and autonomy in their qualitative disclosure.[1] It is noteworthy that even if the disclosed qualitative narrations do not ultimately occur, managers are rarely threatened with legal consequences (Cazier, Merkley, and Treu, 2020). Therefore, managers might be tempted to positively skew information concerning performance prospects by engaging in fluff disclosure to distort the firm's prospects to maximize short-term value (Balvers et al., 2016; Bushee et al., 2022). The latter is strengthen by the fact that managerial narratives about anticipated future events can lead to significant price increases, even when these are not backed by the firm's current economic fundamentals (Shiller, 2020).

The aim of this paper is to investigate whether the managerial disclosure woven into 10-K filings is exploited as a rhetorical mechanism, through which managers convey fluff information to hype investor expectations and inflate stock prices beyond their intrinsic value. In this vein, we examine narratives from the MD&A section that emphasize forward-looking research and development (R&D) activities, and investigate their relation to future idiosyncratic stock price crashes.

We focus our analysis on the MD&A section of the 10-K filings as managers are instructed

[1] Whilst the Securities Act Release No. 6231 (SEC, 1980) mandates the inclusion of the Management's Discussion and Analysis of financial conditions and results of operations in 10-K filings, not all sections of these financial statements are audited. Importantly, the MD&A disclosures are exempt from auditing standards.

by the Securities and Exchange Commission (SEC) to present a "discussion and analysis of a company's business as seen through the eyes of those who manage that business" and it expects a firm's management to "tell its story in its own words" (SEC, 1980).[2] It is the management's opportunity to explain to investors what the financial statements reveal and do not reveal, as well as to highlight important trends and risks that have shaped the past or are reasonably likely to shape the firm's future (SEC, 2007). The narrative nature of MD&A enables managers to be more flexible in communicating with stakeholders and providing forward-looking information that is expected to materially influence the firm (Cole and Jones, 2005). Additionally, as prior research suggests, the users of financial statements base their decision making on information disclosed on MD&A instead of relying on the audited sections of financial statements (AICPA, 2010; Epstein and Palepu, 1999). Ergo, the MD&A section should play a critical role in facilitating the managerial communication regarding forward-looking R&D activities to the entire investment community.

Our motivation for considering R&D managerial narrative disclosure, arises from the fact that R&D is one of the most significant activities that strongly affects firm's long-term viability (Gu, 2016). As noted by Merkley (2014), qualitative information related to R&D activities underscores the importance of narrative disclosure in firms' 10-K filings, particularly given that firms annually invest billions of dollars in R&D projects to create future value and growth. However, in this rapidly changing corporate environment we are experiencing, it is also challenging for investors to accurately assess the value relevance of innovative capabilities fostered by R&D activities (Wyatt, 2008; Cañibano, Garcia-Ayuso, and Sánchez, 2000; Lin, Lee, and Hung, 2006). In this regard, Haddad, Ho, and Loualiche (2022) provide striking evidence that the mere announcement of a potential innovation (*e.g.*, the development of a new product, technology, or methodology) can lead to a 40% increase in the stock price, relative to the actual outcomes or financial benefits that the innovation will generate in the future. This creates a temptation for managers to strategically use

[2] See, also, page 3 of the SEC "Investor Bulletin: How to Read a 10-K".

R&D-related narrative disclosure in 10-K filings, possibly aiming to shape the perception that their firm is forward-thinking and that it is taking actions to succeed in the future.[3]

Going forward, the main research question we consider is whether forward-looking R&D managerial narrative disclosure is an important predictor of stock price crashes. The dependent variable we employ captures the incidence of an extreme left-tail event in the distribution of idiosyncratic returns, which fall more than 3.09 standard deviations below the firm-specific weekly return over a fiscal year. Regarding the primary explanatory variable, we measure it as the percentage of sentences in 10-K filings that feature the co-occurrence of R&D-related keywords or phrases with forward-looking words. We identify a sentence as related to R&D activities if it contains specific R&D keywords or phrases, following a slightly modified dictionary based on Merkley (2014) to which we have added the plural or singular forms of the lexical tokens included in the original one. A sentence is counted only if the R&D keywords or phrases are combined with a word list of forward looking statements. We provide analysis supporting the notion that this measure is contextually relevant and resonates with cues of investor optimism. Specifically, based on a construct validation test, utilizing ChatGPT as an interpretative tool, we demonstrate that it conveys information with the power to positively elevate expectations and fuel optimism among investors.

Using a sample of 16,752 firm-year observations for publicly listed U.S. firms from 1994 to 2021, and consistent with our expectations, we provide evidence showing that managerial narratives featuring forward-looking R&D activities in 10-K filings are positively associated with one-year-ahead stock price crashes. This result remains robust across various measurements of the R&D narratives and within subsamples limited to firms with non-missing R&D expenses. It also persists in the presence of variables controlling for additional textual control variables. Furthermore, we conduct several tests to rule out alternative explanations.

[3] Empirical evidence supports that the R&D expenditures found in financial statements are imprecise measures of a firm's capacity to innovate. Due to accounting standards, they often fail to communicate the true value of R&D, effectively leading to information problems (Lev, 1999; Aboody and Lev, 2000; Merkley, 2014). This naturally strengthens even more the management's temptation to disclose R&D information in 10-K filings.

Specifically, we control for actual R&D activity and efficiency using measures for R&D expenditure and patent metrics (Hirshleifer, Hsu, and Li, 2013). We also account for corporate innovation strategies, controlling for firms' focus on exploitative or exploratory innovations (Jia, 2018b). Moreover, we include CEO overconfidence, as it may influence both innovation outcomes and narrative style (Hirshleifer, Low, and Teoh, 2012; Campbell, Gallmeyer, Johnson, Rutherford, and Stanley, 2011). We confirm that the findings remain unchanged by testing alternative explanations related to the hoarding of bad news mechanism.

To mitigate endogeneity concerns, we employ several econometric approaches, including a difference-in-differences (DiD) test. Specifically, we leverage tariff cuts as a quasi-natural experiment that exogenously triggers an immediate managerial response in the form of rhetoric. Tariff cuts, by reducing barriers to foreign competition, create sudden external pressures, prompting managers to adjust their disclosures as an initial reaction to the intensified competition. The DiD estimator reveals a statistically significant positive relationship between post-tariff cut R&D narrative disclosures and stock price crash risk, providing strong evidence for establishing causality. We also provide an illustrative example of an of event-study DiD estimators in a more dynamic design with multiple groups and periods, where the estimators rely on no-anticipation and parallel trends assumptions, accommodating unbalanced panels and data that may be more disaggregated than the group level. The graph illustrates that, in the subsample experiencing a positive change in R&D narrative disclosure, tariff cuts (which occur at time 0) prompt managers to respond to the increased competition with heightened rhetoric shortly after (at time 1), ultimately leading to a stock price crash in the subsequent period (at time 2). This pattern is not observed in the subsample without a positive change in R&D narrative disclosure.

In cross-sectional analysis, we find evidence that the positive managerial rhetoric-crash risk relation is moderated by various *external* corporate governance measures, often associated with incentivized managers who tend to act strategically to the detriment of shareholders. Specifically, this positive association prevails only among firms facing high competition,

having lower entrenchment, and being actively covered by financial analysts. Interestingly, strong *internal* corporate governance practices−known from prior research to be effective in curbing managerial opportunism−do not appear to weaken this relation. For example, dividing the data into subsets based on the percentage of independent directors (minority *vs.* majority) does not alter the persisting positive relation between narrative disclosures and crash risk. This finding persists when we analyze subsets differentiated by board size, gender diversity on the board, directorship workload, and directors' attendance at board meetings.

We proceed with an analysis to identify and further explore the implications of cheap talk in the corporate innovation outcomes. Specifically, we hypothesize that when a firm experiences a positive change in its narrative disclosure of R&D, which is followed by a subsequent stock price crash risk, it signals that the rhetoric is more likely to be superficial or fluff. This implies that the disclosed intentions may not be backed by substantial action, undermining investor confidence. To test this, we include an interaction term between positive narrative changes and future stock price crash risk in our model. Our results show a negative relationship between this interaction term and patent outputs over the next three years, which lends credence to the presence of cheap talk by observing the detracted firm's innovation performance, as reflected in both the quantity and value of its patents.

This study documents two key contributions to the existing literature. First, our results inform the burgeoning field of stock price crash risk research. Specifically, our findings suggest the existence of a distinct managerial rhetoric mechanism utilized by managers as a vital conduit to convey favorable information and amplify investor optimism. This mechanism differs fundamentally from the widely used mechanism of hoarding of bad news as delineated in the renowned studies of Jin and Myers (2006), Hutton et al. (2009), Kothari et al. (2009) and Benmelech et al. (2010). The hoarding of bad news mechanism focuses on managers' efforts to suppress adverse information to maintain stock prices at artificially high levels, despite a decline in intrinsic value. In contrast, the rhetoric mechanism involves managers strategically using narrative disclosures to inflate expectations and drive stock prices beyond

their intrinsic value. This distinction is pivotal for understanding how future-oriented managerial rhetoric, can shape market perceptions without the need to conceal past negative information.

In addition to the aforementioned aspect, our main result demonstrates that managerial disclosure relating to forward-looking R&D narratives in the management's discussion and analysis section is positively related to one-year-ahead stock price crashes. Our research is complementing a growing body of work that consider the significance of managerial narratives in shaping economic decisions and outcomes (Frankel, Mayew, and Sun, 2010; Davis and Tama-Sweet, 2012; Huang, Teoh, and Zhang, 2014; Akerlof and Snower, 2016; Shiller, 2020; Michalopoulos and Xue, 2021; Garcia, Hu, and Rohrer, 2023). Within this context, prior research has investigated, *inter alia*, earnings announcements and conference calls (Davis et al., 2012; Demers and Vega, 2010; Francis, Schipper, and Vincent, 2002; Price, Doran, Peterson, and Bliss, 2012; Bushee et al., 2022; Hirshleifer, Peng, and Wang, 2023), press releases (Ahern and Sosyura, 2014), linguistic content of media coverage (Chan, 2003; Tetlock, Saar-Tsechansky, and Macskassy, 2008), and the complexity of 10-K filings (Li, 2008; Ertugrul, Lei, Qiu, and Wan, 2017; Kim, Wang, and Zhang, 2019). Whilst offering significant insights, the literature is still in a nascent stage, lacking conclusive evidence on whether managers disclose narratives in an opportunistic fashion. Our findings contribute to this debate, suggesting that managers may exploit sections of the 10-K filings−particularly those less constrained by SEC regulations and accounting standards−to disclose narratives that hype expectations and elevate investor optimism, potentially leading to inflated stock prices at the expense of shareholders. Most importantly, this study identifies cheap talk in managerial rhetoric by linking positive changes in R&D disclosures to stock price crash risk, revealing that such rhetoric, when unsubstantiated, is negatively associated with future patent outputs.

Second, this paper contributes to the body of knowledge on corporate governance and specifically on the effectiveness of internal corporate governance regulations enforced by the

Sarbanes-Oxley Act (SOX) to combat managerial opportunism and protect shareholder welfare (Bhagat and Bolton, 2013a; DeFond, Hung, Li, and Li, 2015; Andreou et al., 2023; Gayle, Li, and Miller, 2022). Whilst existing research provides evidence that the SOX resulted in stricter protection of property rights in governance, and more stringent penalties for fraudulent practices, our study shows that the managerial rhetoric-crash relation persists even under the presence of strong internal corporate governance. Collectively, the results underscore the limitations of internal oversight to prevent managers from exploiting the rhetoric mechanism to engage in short-sighted price maximization at the expense of shareholders.

The remainder of this paper is organized as follows. The next section describes the data and the construction of the study's variables. Section 3 presents the empirical findings and assesses their robustness. Section 4 presents the subsample analyses. Section 5 presents the identification and implication of cheap talk. Finally, Section 6 provides the conclusions.

2 Research design

In this section, we discuss the data employed in our analysis, outline our sample selection criteria and describe how relevant variables are measured. Supplementary to this discussion, Appendix A provides variable definitions and details of their calculation. Appendix B presents the dictionaries featuring the R&D-related and forward looking-related lexical tokens used to construct our main textual variables.

2.1 Data and sample

To construct our sample, we merge data for stock returns from Center for Research in Security Prices (CRSP), covering common stocks traded in NYSE/AMEX/NASDAQ, with CEO data from Execucomp and firm-level data from Compustat for the period 1994-2021. The intersection of these data sets is combined with textual-related variables, which we estimate using 10-K filings from the SEC Edgar database. We then impose the following

common selection criteria in the spirit of prior studies (Hutton et al., 2009; Kim, Li, and Zhang, 2011a; Andreou, Louca, and Petrou, 2017). First, for computing the crash risk measures, we exclude firm-years with (*i*) a stock price less than $1 at the end of fiscal year, and (*ii*) fewer than 26 weeks of stock returns in a fiscal year. Second, we exclude financial firms (SIC 6000-6999) and utilities (SIC 4900-4999). Third, as suggested by Loughran and McDonald (2011), we impose a requirement of at least 250 words in the MD&A section, as this information was much more likely to be "incorporated by reference." The above procedure yields 16,752 firm-year observations, which correspond to 1,996 unique firms from various industries.

2.2 Measuring idiosyncratic stock price crashes

We define a stock price crash as the incidence of an *extreme left-tail event* in the distribution of idiosyncratic returns. Let $w = 1, 2, \ldots, n$ the weeks within a fiscal year t. The *idiosyncratic return*, $R_{j,w}$, for firm j in week w is defined as:

$$R_{j,w} = ln\left(1 + \varepsilon_{j,w}\right), \tag{1}$$

where $\varepsilon_{j,w}$ is a *residual return* from an index model regression. Residual returns are log-transformed to treat for potential positive skewness in raw returns and enables to symmetrically identify extreme left- *vs.* right-tail events. Then, $\varepsilon_{j,w}$ is estimated as the residual from an expanded market and industry index model regression, as follows:

$$r_{j,w} = \alpha + \sum_{i=-1}^{i=1} \beta_{i,j} r_{MKT,w+i} + \sum_{i=-1}^{i=1} \gamma_{i,j} r_{IND,w+i} + \varepsilon_{j,w}, \tag{2}$$

where $r_{j,w}$ is firm's j stock return, $r_{MKT,w}$ is the CRSP value-weighted market index return, and $r_{IND,w}$ is the Fama and French (1997) value-weighted 48-industry index return in week w. The index model includes two lead and lag weekly return terms for the market and industry indices, to control for booms and busts that might happen around the week of

interest allowing to measure the firm's residual return with higher precision. To preclude look-ahead bias that accounts for the effect of earnings release when the subsequent crash risk measures are matched with financial data, *Eq.* (2) is estimated over the 52-week window ending 13 weeks after the fiscal year-end.

We define $CRASH_{j,t}$ as an idiosyncratic, extreme left-tail event measured with a binary variable set equal to one if within fiscal t the firm j experiences at least one "crash week," *i.e.*, an extreme negative weekly idiosyncratic return that falls more than λ standard deviations below its mean idiosyncratic return, and zero otherwise. Specifically,

$$CRASH_{j,t} = \begin{cases} 1 & \text{if } \exists w = 1, 2, \ldots, n : R_{j,w} < \mu_{j,t} - \lambda \times \sigma_{j,t} \\ 0, & \textit{otherwise} \end{cases}, \tag{3}$$

where $\mu_{j,t}$ and $\sigma_{j,t}$ are, respectively, the mean and standard deviation of the idiosyncratic returns over the weeks that fall within fiscal year t. Following the norm in the crash risk, we set λ equal to 3.09 to generate a frequency of 0.1% extreme left-tail events as per the normal distribution.

2.3 Measuring forward-looking narrative disclosure of R&D activities

Prior studies provide supporting evidence that managers exert significant influence on the quality of financial reporting (Amernic, Craig, and Tourish, 2010). In this context, Li (2008) reports that managers tend to alter the tone of R&D disclosures and rely on vague wording to obscure or positively spin earnings performance, whilst Merkley (2014) provides evidence suggesting that CEOs adjust R&D disclosures based on earnings performance to convey information to the investors. Furthermore, more recent work in this direction provides stimulating evidence suggesting that managerial narratives in firms that disclose R&D in their 10-K filings are attracting short-term horizon investors who act opportunistically and focus their investments on the likelihood of reaping short-term gains (Andreou, Drivas,

Philip, and Wood, 2024).

A stream of literature provides evidence supporting the notion that the users of financial disclosures, instead of basing their decisions mainly on the audited parts of financial statements, they may rely more on the Management Discussion and Analysis (MD&A) (AICPA, 2010; Epstein and Palepu, 1999). At the same time, the MD&A is one of the most widely read disclosures in annual reports (Li, 2019). However, questions have been raised about the trustworthiness of prolonged use of the narrative sections of 10-K filings, especially when the information is not combined with data extracted from firm's fundamentals. In fact, the nature of management disclosures, which often consists of qualitative and unverifiable information rather than quantifiable data, offer the leeway to self-interested managers to intentionally tailor them in ways that hype investor optimism (Neu, Warsame, and Pedwell, 1998).

To serve the purpose of our study, we use a firm's forward-looking narrative disclosure of R&D activities in the MD&A section of its 10-K filing to operationalize managerial rhetoric. This is done in three-steps. In the first step, for firm j in fiscal year t, we define the percentage of narrative disclosure of R&D activities in the MD&A section, as follows:

$$Narrative\ MD\&A_{j,t} = \frac{Total\ number\ of\ R\&D\ sentences}{Total\ number\ of\ sentences} \times 100. \tag{4}$$

For identifying narrative R&D activity disclosures at the sentence level, we utilize a slightly modified dictionary of Merkley (2014) by adding the plural or singular forms and third person of the lexical tokens included in the original one. Based on this dictionary, the numerator of *Eq.* (4) counts sentences when they include at least one R&D-related lexical token, such as "*research and development,*" "*R&D,*" "*product/s development,*" "*development of new product/s,*" "*technological breakthrough/s,*" "*development of proprietary technology/ies,*" *et cetera* (Appendix B features the list of lexical tokens).

In the second step, our aim is to operationalize managerial rhetoric to capture the man-

agers' tendencies to disclose R&D-related activities in the MD&A section, which could potentially hype investor expectations regarding the firms' future prospects. We posit that this is more likely when managers are narrating *forward-looking* R&D activities, which are intrinsically challenging to evaluate and verify for their value relevance. Ergo, for firm j in fiscal year t, we define the percentage of forward-looking narrative disclosures of R&D activities within the MD&A section, as follows:

$$Narrative\ FLS{-}MD\&A^{\bigstar}_{j,t} = \frac{Total\ number\ of\ R\&D\ sentences\ including\ FLS}{Total\ number\ of\ sentences} \times 100, \quad (5)$$

whereby FLS contains a set of forward-looking keywords and phrases derived from a combination of dictionaries proposed by Li (2010), Muslu et al. (2015), Matsumoto, Pronk, and Roelofsen (2011), Athanasakou and Hussainey (2014), Hussainey, Schleicher, and Walker (2003), Hassanein and Hussainey (2015), such as "*will,*" "*could,*" "*should,*" "*expect,*" "*anticipate,*" "*plan,*" "*hope,*" "*believe,*" "*can,*" "*may,*" "*might,*" "*intend,*" "*project,*" "*forecast,*" "*objective*" and "*goal*". Consequently, an R&D sentence is treated as forward-looking if it contains any of these future tense words, indicating narratives referring to activities that managers anticipate happening in the future.

In the third step, we construct our managerial rhetoric measure as a 3-year weighted average of forward-looking narrative disclosures of R&D activities within the MD&A section. This measure can be linked to the concept of hoarding bad news, but focuses on reporting forward-looking information rather than withholding negative news. By analyzing a three-year span of forward-looking R&D sentences, not only we capture the consistency and systematic nature of reporting, in accordance with the hoarding of bad news mechanism, but also, we smooth out short-term variations to provide a more accurate reflection of the company's long-term R&D strategies, in line with the typical planning horizon used in R&D. Weighting recent narratives more heavily emphasizes that the most current disclosures are more indicative of the company's latest strategic intentions and research focus and reflects

the company's immediate future prospects that can exert greater influence to the investment community. To convert this concept into a measurable form, we apply geometrically decreasing weights for the 3-year values, drawing on the method of Campbell, Hilscher, and Szilagyi (2008), and construct our main explanatory variable as follows:

$$\begin{aligned} Narrative\ FLS-MD\&A_{j,t} &= \hat{w}_1 \times Narrative\ FLS-MD\&A^{\bigstar}_{j,t} \\ +\hat{w}_2 \times Narrative\ FLS-MD\&A^{\bigstar}_{j,t-1} &+ \hat{w}_3 \times Narrative\ FLS-MD\&A^{\bigstar}_{j,t-2} \end{aligned} \tag{6}$$

The construction of weights is based on the geometric progression pattern λ^{α}, where λ is the decay factor and α is the exponent that varies across the weights. The weights are calculated as follows:

$$w_1 = \frac{1}{1+\lambda+\lambda^2}, \quad w_2 = \frac{\lambda}{1+\lambda+\lambda^2}, \quad w_3 = \frac{\lambda^2}{1+\lambda+\lambda^2}, \tag{7}$$

whereby when estimating $Narrative\ FLS-MD\&A_{j,t}$ we set $\lambda = 2^{-1/3}$ resulting in a weighting scheme of $w_1 = 41.3\%$, $w_2 = 32.7\%$ and $w_3 = 26\%$.

We also consider alternative weighting in robustness tests. The second alternative explanatory variable, *Narrative FLS−MD&A* (2), is measured as a 3-year weighted average of the forward-looking narrative disclosures of R&D activities within the MD&A section as per *Eqs.* (6) and (7), using $\lambda = 2^{-2/3}$ which results in a weighting scheme of 49.3%, 31.1% and 19.6%. The third alternative explanatory variable, *Narrative FLS−MD&A* (3), is measured as a 3-year simple average of the forward-looking narrative disclosures of R&D activities within the MD&A section, using an equal weighting scheme of 33.33%. The fourth alternative explanatory variable, *Narrative FLS−MD&A* (4) is measured as a 3-year weighted average of the forward-looking narrative disclosures of R&D activities within the MD&A section as per *Eqs.* (6) and (7), using an ad hoc weighting scheme of 50%, 30% and 20%.

2.3.1 Forward-looking narrative disclosure of R&D activities and investor optimism

To ensure that the managerial rhetoric from *Eq.* (5) is contextually relevant, we investigate whether it resonates with cues of investor optimism. We perform a construct validation test, which consists of an interpretation of excerpts from the MD&A section of 10-K filings using ChatGPT.

Validating a measure is an essential step in ensuring the accuracy and integrity of research endeavors. As Kerlinger, Lee, and Bhanthumnavin (2000) and Short, Broberg, Cogliser, and Brigham (2010) point out, construct validity is a pivotal aspect of allowing researchers to demonstrate the appropriateness of their measures in capturing the concepts they intend to study. Accordingly, we investigate whether our measure underscores the persuasive power of managerial rhetoric in shaping investor expectations regarding a firm's future prospects. This can be reasonably justified by the fact that R&D activities are associated with the generation of new products, technologies, or processes that may fuel future growth (Lin, 2012). In this respect, it is reasonable to argue that the market assesses the potential for growth by considering the information disclosed by the firm, including narrative disclosure of R&D activities combined with forward-looking statements.

Specifically, for our validation test, we employ ChatGPT as an interpretative tool to discern whether excerpts used to construct *Narrative FLS−MD&A* align with cues indicative of investor optimism. To do so, we hand collect 150 random statements from the MD&A section of 10-K filings, drawing on Merkley (2014) for determining the sample size. We then present these statements to ChatGPT for interpretation, accompanied by a set of instructions. Particularly, the AI is tasked to determine (1) whether the statements indicate positive or negative future prospects for the firm; (2) the nature of expectations these statements establish−positive or negative; and (3) the potential of these statements to fuel investor optimism. An indicative set of excerpts are illustrated in the Internet Appendix.

To exemplify this methodological approach, we reference an excerpt from Intel's MD&A section from its 2010 10-K filing:

With the launch of our 32nm products and fourth quarter record shipments of microprocessor units, we are entering 2010 in a strong competitive position as we continue delivering improvements in our product offerings through the "tick-tock" manufacturing process technology and product development cadence. We are also focusing on the development of a new highly scalable, many-core architecture aimed at parallel processing, the simultaneous use of multiple cores to execute a computing task. This architecture will initially be used as a software development platform for graphics and throughput computing (the need for large amounts of computing performance consistently over a long period of time). Over time, this architecture may be utilized in the development of products for scientific and professional workstations as well as high-performance computing applications.

ChatGPT's interpretation vis-à-vis to the above instructions is as follows:

(1) ***Based on the provided statements, the company has positive future prospects.*** *The statements highlight the launch of 32nm products, record shipments of microprocessor units, and improvements in product offerings through the "tick-tock" manufacturing process technology and product development cadence. This indicates a strong competitive position and a focus on delivering advancements in their product lineup.*

(2) ***The statements create positive expectations.*** *The mention of the launch of new products, record shipments, and a focus on continuous improvements through manufacturing process technology and product development cadence indicates a commitment to innovation and staying competitive in the market. The company's focus on developing a highly scalable, many-core architecture for parallel processing further reinforces its dedication to advancing its technology offerings. These factors generate positive expectations for the company's future performance.*

(3) ***These statements possess a strong potential to fuel investor optimism.*** *The company's achievements, such as the launch of new products, record shipments, and a commitment to continuous improvements, are positive indicators for investors. Investors generally value companies that demonstrate a strong competitive position, innovation, and a focus on staying ahead of market trends. The mention of the development of a highly scalable, many-core architecture for parallel processing expands the potential market reach, which can further fuel investor optimism about the company's*

growth potential and market opportunities.

Altogether, based on the insights derived from the ChatGPT assessment, it appears that managerial narratives emphasizing forward-looking R&D activities predominantly convey positive information. This style of narrative disclosure inherently possesses the power to elevate expectations and fuel optimism among investors. Further, by emphasizing forward-looking R&D activities, managers accentuate their dedication to persistent growth and consistent innovation, even though the realization of outcomes lies in the future.

2.4 Control variables

Following prior studies (Hutton et al., 2009; Kim and Zhang, 2016; Callen and Fang, 2013; Andreou et al., 2023; He and Ren, 2022), we account for *Leverage*, estimated as the ratio of total liabilities to total assets; *Market to Book*, the ratio of market value to book value of equity; *Return on Equity*, estimated as the ratio of income before extraordinary items to equity; *Size*, estimated as the natural logarithm of total assets; and *Firm Age*, estimated as the number of years that the firm is covered in the Compustat universe. Consistent with Merkley (2014), we control for current earnings performance by using adjusted return on assets, *Return on Assets*, measured as annual operating earnings before R&D and advertising expense scaled by total assets. Further, we control for past *Stock Return* estimated as the average of the idiosyncratic weekly returns during the fiscal year (Chen, Hong, and Stein, 2001). The inclusion of *Detrended Turnover*, estimated as the detrended average weekly stock trading volume during the fiscal year, controls for time-varying impacts on skewness. Additionally, we control for Altman (1968)'s *Zscore* to ensure that our findings are not driven by the financial distress or health of the firms being studied. We also include lagged values of the negative coefficient of skewness, *Ncskew*, to circumvent endogeneity concerns. To control for the tone of the text features, we include $Sentiment{-}MD\&A$, which is measured as the percentage of positive words minus the percentage of negative words as defined by

Loughran and McDonald (2011) dictionary, sourced from the MD&A section of 10-K filings. Additionally, since CEOs are appeared to act opportunistically in the years prior to their departures by overly hiding negative news from investors, to increase their personal wealth (Andreou, Lambertides, and Magidou, 2020), we control for departing CEOs. Specifically, *CEO Depart* is proxied by a binary variable set equal to one if there is a departure of firm's CEO, during the fiscal year t, and zero otherwise. We also use binary variables set equal to one for one, two or three fiscal years before the year of the CEO's departure, (denoted as *CEO Depart 1Y Before*, *CEO Depart 2Y Before* and *CEO Depart 3Y Before*, respectively), to capture the opportunistic behavior which could be more severe during this timing.

3 Discussion of empirical findings

In this section, we conduct a series of empirical analyses to examine the relation between R&D narrative disclosure and future stock price crashes. We begin by summarizing the sample and discussing the univariate associations. Subsequently, we undertake multivariate regression analysis, incorporating controls for a range of firm-specific attributes. We also present several robustness checks and additional analyses including a difference-in-differences test.

3.1 Summary statistics and correlation analysis

Table 1 presents summary statistics for the variables employed in the baseline empirical analysis. The 0.249 mean value of the *CRASH* suggests that approximately 25% of firm-years demonstrate at least one crash week. The mean and standard deviation of the crash risk measure are comparable to those reported in prior studies (*e.g.*, Kim et al., 2011a; Kim, Li, and Zhang, 2011b; Andreou, Antoniou, Horton, and Louca, 2016). On average the percentage of R&D-related sentences (*Narrative MD&A*) is 1.911, whilst for the forward-looking R&D-related sentences (*Narrative FLS−MD&A*) is 0.586. In terms of *Sentiment−MD&A*, the

mean is −0.832 indicating that the average negative tone prevails over the positive.

The distribution characteristics of control variables are largely consistent with those reported in prior studies. For instance, the average firm in our sample has total assets of 6,241.8 million USD, firm age of 25.440 years, market to book ratio of 3.476 and total liabilities to total assets of 0.517. The sample firms have mean return on assets 0.033, return on equity 0.070 and weekly return 0.053. The detrended average weekly stock trading volume is 0.001, the Zscore is 1.040 and the mean negative coefficient of skewness is 0.027. Finally, the mean of CEO Depart is 0.111, indicating that approximately 11% of firm-years experience a change in firm's management.

[Insert Table 1, here]

Table 2 reports the Pearson correlation coefficients between the variables considered in the baseline analysis. As expected, a high correlation is evident between the narrative proxies, *Narrative FLS−MD&A* and *Narrative MD&A*. The univariate analysis results show a statistically significant positive correlation between stock price crash risk (as measured by *CRASH*) and the narrative disclosure of R&D activities in 10-K filings (represented by either *Narrative FLS−MD&A* or *Narrative MD&A*). All other variables do not show high correlations to raise concerns of multicollinearity.

[Insert Table 2, here]

3.2 Baseline regression results

This section provides insights into how managers hype investors' expectations using the managerial narratives disclosed in publicly available annual reports. To this end, we examine the relation between managerial narrative and future stock price crashes using multivariate regression analysis. The main analysis is presented in Table 3. Specifically, model (1) utilizes the main explanatory variable *Narrative FLS−MD&A*. We also test alternative weighting schemes to demonstrate that our results are robust and not sensitive to the specific weighting

scheme used. These results are presented in models (2), (3) and (4) and include a 49.3%, 31.1% and 19.6% weighting structure, a simple average of equal weights and another weighting structure of 50%, 30%, and 20%, respectively. Moreover, to evaluate the impact by only considering the most recent data, we show in model (5) the results with the measure based solely on the forward-looking R&D sentences from the latest year, instead of a 3-year weighting average. Lastly, we narrow the focus to R&D discussions, by presenting in model (6) the results using the measure that exclusively includes sentences containing only R&D-related terms as an explanatory. The estimates include industry and year fixed effects to control for unobserved time-invariant effects. Robust standard errors provided in parentheses below the coefficient estimates are clustered at the firm level.

The estimates reported in Table 3, Panel A are obtained using the full sample. The results show a positive statistically significant (p-value<0.01) relation between the narrative measures and one-year-ahead stock price crash risk.[4] To ensure that these findings are not driven by firms with zero R&D expense, in Panel B we re-examine our analysis on the subsample with non-missing R&D expense data. The results suggest an even stronger positive and statistically significant relation between R&D narrative disclosure and future stock price crash risk.

[Insert Table 3, here]

3.3 Placebo Test - Support of the managerial rhetoric mechanism

Rhetoric can be considered as the art of utilizing effectively convincing communication. It entails the clear and convincing narratological concepts in order to persuade people and influence their opinions by conveying a message through specific rhetorical devices. In the corporate world, these rhetorical devices are utilized to convince investors for future success

[4] To ensure robustness, in Table IA4 of the Internet Appendix, we augment the baseline model by incorporating additional 10-K textual related variables (Uncertainty, Modal Weak, Litigious, Readability) that might influence the relationship between R&D narrative disclosure and stock price crash risk. Results show that these variables do not affect the observed relationship.

using strategic communication. In this vein, we *expect* that the R&D narrative disclosed in the MD&A section to persuasively convey messages and convince or shape the opinions of investors. In contrast, we would *not expect* these rhetorical devices to exist either in the entire 10-K filing or the Risk Factors section. If this is the case, then the absence of evidence from the entire 10-K and Risk Factor section can be supportive for the existence of a managerial rhetoric mechanism that derives from the MD&A section.

Accordingly, we perform a placebo test by applying the same narrative proxies used in the main analysis presented in Table 3 to the entire 10-K filing (10-K) and the Risk Factors (RF) section. We do not expect the same impact of forward-looking R&D narrative disclosures. Specifically, as both sections are less likely to contain the same persuasive narratives as the MD&A section. By testing whether these sections exhibit a similar relation between narrative disclosures and future stock price crash risk, we can confirm that the effect observed in the MD&A section is not spurious. In the analysis presented in Table 4, where in Panel A the source of textual information for the analysis it is derived from the entire 10-K filing, whilst in Panel B it is derived from the Risk Factors section, we find no significant relationship. The results in both cases support our expectation that rhetorical devices in the MD&A section are uniquely influential, thus reinforcing the presence of a managerial rhetoric mechanism that shapes investor perceptions and influences stock price risk.

The relation between narrative and future stock price crashes presented in Table 4 diverges from the one in Table 3. In both contexts−whether considering the entire 10-K filings or the Risk Factors−the relation is non-significant. This indicates that investors particularly value the narratives within the MD&A section, whereas content from other sections might not significantly skew their perceptions. These results align with our expectations, highlighting the presence of a managerial rhetoric mechanism wherein managers tailor narratives to positively influence public impressions.

[Insert Table 4, here]

3.4 Endogeneity treatments

We employ alternative econometric approaches to address potential endogeneity concerns and provide evidence in support of a causal relation between managerial narrative and stock price crash risk. For this purpose, we conduct four different tests.

First, to achieve a relatively more powerful approach towards time-invariant omitted variables, we include firm fixed effects in our baseline model. Also, we add high dimensional fixed effects, which are interactions of firm quintiles (*i.e.*, grouping firms into quintiles based on their basic characteristics) and time dummies.[5] In doing so, we account for unobserved firm heterogeneity that may confound the estimation of the effect of our variables of interest (Gormley and Matsa, 2014). Second, we mitigate reverse causality issues by estimating regression models where we swap crash risk with managerial narrative. Third, to account for measurement error, we perform an additional iteration of the baseline model, where we substitute the original continuous explanatory variable with a categorical variable. These newly created categorical variables are constructed based on the deciles, quintiles, and tertiles derived from the original continuous variable. The results of this analysis lend further support to the positive relation between managerial R&D narrative and one-year-ahead crash risk. An extensive discussion of these results is provided in the Internet Appendix.

More importantly, we strengthen our inferences by conducting a difference-in-differences (DiD) analysis utilizing tariff cuts as a quasi-natural experiment that causes an exogenous change of managerial narrative. The exogenous event of a tariff cut satisfies the requirements of representing an ideal framework to establish causality and according to Li and Zhan (2019a), tariff cuts fulfil the exclusion condition because they are not associated with idiosyncratic stock price crash risk.

Import tariffs, as per Bernard, Jensen, Redding, and Schott (2007) and Erdem and Tybout (2003), act as a significant barrier of entry for foreign competition and accordingly

[5] The high dimensional fixed effects are conducted using both a linear probability model and a poisson pseudo-maximum likelihood model, due to the computational intensity of conducting a logit model.

minimize pressure exerted from competitors. Therefore, tariff cuts create a sudden increase in competition by reducing barriers to international trade, exposing firms to new market dynamics and competitive pressures. We can reasonably assume that this intensified competition caused by a tariff cut compels managers to address these changes proactively in their disclosures. This assumption is justified by the argument that managers cannot react immediately to such changes. Consequently, before implementing strategic or operational responses, managers use narrative disclosures to communicate the new market environment, reassure stakeholders, and align investor expectations. As a result, they are more likely to start increasing their narrative disclosure in the MD&A section of 10-K filings, with an emphasis on forward-looking research and development (R&D) activities. In this context, managerial narrative disclosure may bridge the gap between external shocks, like tariff cuts, and the subsequent actions firms undertake to adapt, making it a first-order response to competitive pressures.

We obtain annual product-level U.S. import data from the publicly available U.S. International Trade Commission (USITC) DataWeb. This dataset is then aggregated by district, year, and industry, as defined by NAIC number. Each firm-year observation in our sample is classified into its respective state based on the district. Following the methodology outlined by Li and Zhan (2019b), we identify a tariff reduction within a specific industry-year when a change results in at least 2.5 times increase in imports compared to the median change. Subsequently, we employ a DiD framework based on this exogenous event. To accomplish this, we restrict our sample to U.S. states that have undergone a tariff cut and apply the before-after model, as suggested by Duchin, Ozbas, and Sensoy (2010). Accordingly, we construct the binary variable *After*, which is set equal to one if an industry has experienced a tariff cut over the last three years. To ensure robustness, we also test the binary variable with tariff cut periods of four years and five years. This variable, along with its interaction with managerial rhetoric, is integrated into the baseline model. This model also includes firm fixed effects which account for the level effect of narratives, and control for all sources

of time-invariant variation across firms, whether observed or unobserved.

The DiD setting enables us to estimate−through the tariff cut−the causal effect of the relation between R&D narrative disclosure and stock price crash risk. The DiD estimator (*After*Narrative FLS−MD&A*) captures the average differential change in stock price crash risk in the post-tariff cut period, thereby enabling us to identify the causal effect under scrutiny. The results reported in Models (1) and (2) of Table 5 show a strong statistically significant (at the 1% level) positive interaction term for the three-year post-tariff cut period. This suggests that, notwithstanding the substantial fluctuations in trade barriers induced by the exogenous tariff reduction, there is evidence to suggest a causal relation between managerial narrative and the likelihood of subsequent stock price crashes. When extending the time-frames of the analysis to four (Models (3) and (4)) and five years (Models (5) and (6)), the interaction term remains positive and significant, though at the 5% and 10% level, respectively. This progressive decline in significance reflects the expected diminishing effect of the managerial rhetoric on stock price crash risk, as we move further from the tariff cut event.

[Insert Table 5, here]

To further validate our findings, we proceed with an event-study DiD estimators in a more dynamic design that includes multiple groups and periods to also provide an illustrative example. This design is based on the key assumptions of no anticipation and parallel trends, and it accommodates unbalanced panels and potentially more disaggregated data than at the group level. In this analysis, the tariff cut serves again as the treatment, occurring at time 0. The analysis is conducted among two different subsamples; the subsample experiencing a positive change in R&D narrative disclosure is compared with a subsample where no such change occurs. The event-study results, illustrated in the figure 1, show a clear dynamic pattern for the subsample with the positive change in R&D narrative disclosure: when the tariff cut occurs, managers respond to the increased competition with heightened rhetoric at time 1, which, in turn, leads to a stock price crash in the subsequent period (time 2).

This pattern of heightened rhetoric followed by a stock price crash is not observed in the subsample that did not experience a positive change in R&D narrative disclosure. This dynamic design allows us to further investigate the causal effect of R&D narrative disclosure on stock price crash risk, while controlling for potential confounding factors and ensuring that the observed effects are due to the managerial response to the tariff cut rather than other variables.

[Insert figure 1, here]

3.5 Testing the alternative explanation of actual innovation activity

In this section, we address and eliminate a potential alternative explanation. Specifically, we aim to test whether our main finding of the relation between narratives R&D and crash risk is not the reflection of the actual R&D activity along with its output efficiency. Actual R&D expenditures and the efficiency of R&D outcomes, such as patents, could independently influence stock price crash risk. Controlling for R&D activity and efficiency is crucial in our setting as it enables us to better isolate the specific effect that the narratives have on stock price crash risk and show that the narratives themselves have a significant predictive power over and above the underlying R&D activities. To address the concern of conflating the impact of R&D activity with the effect of the narratives, in Table 6 we control for actual R&D activity and corresponding efficiency by including in our baseline model five alternative proxies, specifically: R&D expenditure divided by sales in model (1); R&D expenditure divided by total assets in model (2); number of patents granted to the firm weighted with their citations in model (3); patents granted divided by R&D capital (as in Hirshleifer et al., 2013) in model (4); and patents granted weighted with their citations scaled by R&D capital in model (5).

Prior literature on corporate innovation strategies (Jia, 2018a) also suggests that firms focused on exploration, which encompasses disruptive innovations, and the pursuit of novel opportunities, are more prone to stock price crash risk. On the other hand, those focused on

exploitation, which focuses on expanding current technologies, are less vulnerable to experience a stock price crash. In line with the above, we include *Exploitative* and *Explorative* variables, which are measured as the percentage of exploitative/exploratory patents relatively to the number of all patents filed by the firm in the same year (a patent is classified as exploitative/exploratory if at least 60% of its citations are based on existing/new knowledge), in models (6) and (7), respectively.

Previous research also demonstrates that firms led by overconfident CEOs tend to secure a greater number of patents and citations, and achieve higher innovative success (Hirshleifer et al., 2012). Since overconfidence can enhance a CEO's ability to exploit innovative growth opportunities, controlling for CEO overconfidence in model (8), can help us to ensure that our findings are not influenced by the possibility that overconfident CEOs may also be more prone to discussing innovation extensively in their narratives. CEO overconfidence is measured by using a binary variable following Campbell et al. (2011), set equal to one if the CEO is classified as overconfident based on their tendency to hold options deep in the money (greater than 100%), and zero otherwise.

Altogether, the results in Table 6 show that the coefficients of *Narrative FLS−MD&A* remain statistically positive in predicting future stock price crash risk after controlling for the above-mentioned variables.

[Insert Table 6, here]

3.6 Controlling for the hoarding of bad news mechanism

In this section, we augment our baseline regressions by incorporating alternative proxies for the hoarding of bad news mechanism. This mechanism, which aims to control what information is disclosed, is independent of managerial rhetoric, which focuses on disseminating information to shape investors' perceptions. While both strategies influence how firms are viewed, their key distinction lies in intent: the hoarding of bad news seeks to withhold unfavorable information.

The literature identifies two primary channels of bad news hoarding: financial reporting opacity and overinvestment (e.g., Hutton et al. (2009), Kim et al. (2011a), Callen and Fang (2013), Callen and Fang (2015), Andreou et al. (2016), Kim and Zhang (2016), Andreou et al. (2017)). Financial reporting opacity, often achieved through systematic accrual-based earnings management (Dechow, Sloan, and Sweeney, 1995), allows managers to obscure unfavorable outcomes (Hutton et al., 2009). Overinvestment, as described by Benmelech et al. (2010), leverages information asymmetries to conceal adverse news, often driven by managerial self-interest. Additional strategies, such as depreciation manipulation (Bartov, 1993; Bushee, 1998; Breton and Stolowy, 2004) and R&D expenditure pruning (Baber, Fairfield, and Haggard, 1991; Perry and Grinaker, 1994; Bange and De Bondt, 1998; Cheng, 2004) further illustrate how managers achieve earnings management objectives.

Admittedly, this step becomes necessary to enable us to show that the variables, which are strongly associated with the hoarding of bad news mechanism, do not confound our results. Therefore, we take into consideration measures for (*i*) *Opacity*, which is measured as the cumulative sum of the absolute value of discretionary accruals (based on the modified Jones approach) over the previous three years, is estimated in the spirit of Hutton et al. (2009) and (*i*) *Overinvestment*, which is measured following the approach developed by Richardson (2006), using Tobin's Q as the proxy for growth opportunities, augmented by the industrial sales growth rate, in the spirit of He and Lin (2022). Equity compensation variables (option and stock incentives) are also incorporated to account for potential confounding effects (Kim et al., 2011a). All models control for (*ii*) *Depreciation*, which is measured as the depreciation expense divided by total assets, and (*iii*) *R&D Cut*, which is an binary variable set equal to one when the R&D expenditure has decreased from previous year, and zero otherwise.

Results in Table 7 confirm that hoarding-related variables do not materially affect the positive relation between managerial narrative and crash risk, since R&D narrative disclosure remains positive and statistically significant beyond these variables. In this regard, this finding also supports that our proposed mechanism is distinct from that based on the

hoarding of bad news and highlight the distinctiveness of managerial rhetoric, which appears to operate over and above the hoarding of bad news mechanism. [6]

[Insert Table 7, here]

4 The role of corporate governance

The empirical analysis provided in this section investigates the relation between managerial narrative and crash risk through the lenses of external and internal corporate governance mechanisms. This taxonomy abides by the literature that extensively emphasizes the importance of certain corporate governance functions in mitigating the agency-based reasons responsible for stock price crashes (*e.g.*, Jensen 1993; Ashbaugh-Skaife, Collins, and LaFond 2006; Fich and Shivdasani 2006; Coles, Daniel, and Naveen 2008; Callen and Fang 2013; Andreou et al. 2016; Li and Zeng 2019). Further, corporate governance mechanisms that fall under these categories are designed to increase or enhance the monitoring of management actions to promote effective decision-making, limit opportunistic behavior and reduce the information asymmetry between the firm and its external stakeholders.

In the absence of appropriate monitoring and disciplining corporate governance functions, managers have more leeway to act opportunistically in hoarding bad news to maximize their own wealth to the detriment of shareholder welfare (Callen and Fang, 2013, 2015; Andreou et al., 2016). In this vein, the extensive body of research on crash risk suggests that the fundamental trigger behind stock price crashes is the hoarding of bad news mechanism. The bulk of the literature which focuses on firm-specific explanations primarily draws from the

[6] We also examine whether our inferences hold when using alternative measures for: (i) opacity, proxied by the probability of misstatement (Dechow, Ge, Larson, and Sloan, 2011), accruals quality (Dechow and Dichev, 2002), earnings smoothing (Tucker and Zarowin, 2006), accounting conservatism (Khan and Watts, 2009), and real earnings management Roychowdhury, 2006; Cohen and Zarowin, 2010 and (ii) overinvestment, proxied by the measure proposed by (Richardson, 2006), the inefficient investment proxy from (Hubbard, 1998), and four alternative industry-adjusted capital expenditure measures. The regression results, presented in Table IA5 of the Internet Appendix, confirm that our inferences remain consistent across all alternative measures.

agency models developed by Jin and Myers (2006) and Benmelech et al. (2010) and proposes opacity and overinvestment as the channels through which managers strategically hide unfavorable news. As a result, exploiting the ideal environment of inadequate monitoring, these two channels provide managers with the means to consistently participate in opportunistic actions through the concealment of unfavorable information that could be proved detrimental for the firm.

However, over the past twenty years, there has been a notable improvement in the corporate governance regulations aimed at addressing managerial opportunism and safeguarding the interests of shareholders (Bhagat and Bolton, 2013b; DeFond and Zhang, 2014; Company, 2018; O'Kelley R. and Reynolds, 2018; Wintoki, 2007). Recent empirical evidence suggests the inefficacy of opacity and overinvestment to rationalize the upsurge in the stock price crash risk phenomenon and ascribed it to the sustained efforts of gatekeepers and fiduciary agents that have significantly contributed to improving corporate governance, fostering in this fashion more effective monitoring and disciplining processes for publicly listed U.S. firms (Andreou et al., 2023). These improvements aid in alleviating agency-related concerns for the typical firm and highlight the crucial role of corporate governance in mitigating stock price crashes by shaping the transparency, accountability, and decision-making processes within a company. However, while corporate governance has shown promise in addressing the hoarding of bad news mechanism, it's uncertain whether it can curtail managers from exploiting the managerial rhetoric mechanism. This is the gist of our empirical investigation in this section.

4.1 External governance

We perform a subsample analysis to investigate whether external corporate governance has any impact on the relation between managerial narrative and stock price crash risk. Specifically, we consider variables related to competitive environment measured as the sum of the square market share of all the firms in an industry−where the market share refers

to the sales of the firm over the total sales of all firms in each industry (Rhoades, 1993), managerial entrenchment measured as the number of extra titles the CEO holds (the CEO receives one extra point for chair or president, one for founder and one if it also holds the title of CFO or COO) (Al Mamun, Balachandran, and Duong, 2020), and investors' attention measured by a binary variable set equal to one if the firm has at least one analyst following, and zero otherwise. We divide firms into subsamples based on their level of external governance. The High/Low *Competitiveness* subsamples comprise observations as defined by the above/below median of the *Competitiveness*. The High/Low *Entrenchment* subsamples comprise observations as defined by the managers that hold at least one extra title versus the rest that do not hold any other extra titles. The *Analysts* subsamples comprise observations where the number of analysts is either at least one or zero.

These results are reported in Table 8. Models (1) and (2) show that the positive relation between the managerial narrative and crash risk is only prevalent among firms that are facing relatively high competition. This finding is in line with the view that a highly competitive environment exert pressure to firms facing more threats, which in turn make their firms more vulnerable in experiencing a stock price crash (Li and Zhan, 2019a). Models (3) and (4) show that the relation between managerial narrative and crash risk exist among the low *Entrenchment* subsample in which managers have a relatively low power. A higher power proxied by the number of titles they hold safeguards CEOs from the possibility to be replaced and reduces the likelihood of losing their job. Therefore, in such cases, managers feel more secured and have lower incentives to utilize the power of narrative to cater to investor expectations. Models (5) and (6) show that the managerial rhetoric-crash relation appears only among firms with analysts' coverage consistent with the view that analysts serve as transponders of firms' information to the investment community. This is reasonable considering that such firms are more likely to attract investors' attention.

Overall, the results indicate that external pressures−such as a highly competitive environment, takeover threats, or investors' attention−possibly stipulate managers to exploit

rhetorical devices as a mean to strategically bias their narratives in a self-serving fashion.

[Insert Table 8, here]

4.2 Internal governance

Likewise, we conduct a subsample analysis to examine whether internal corporate governance. In this context, we consider variables related to the composition and characteristics of the board of directors, such as the board size, the majority of independent directors and the number of female, busy and not attended directors (*e.g.*, Andreou et al., 2016; Li and Zeng, 2019; Kim, Li, and Li, 2014; Dang, Lee, Liu, and Zeng, 2018; Ni, Peng, Yin, and Zhang, 2020; Hasan, Taylor, and Richardson, 2022). We divide firms into subsamples based on their level of internal governance. The High/Low *Board Size* subsamples comprise observations as defined by the above/below median number of board members. The *Percentage of Independent Directors* subsamples comprises observations where the independent directors on a board have the majority or minority. The *Number of Female Directors* subsamples comprise observations where the number of female directors is either at least one, or zero. The *Number of Busy Directors* subsamples comprise observations where the number of busy directors is either at least one or zero. The *Number of Not Attended Directors* subsamples comprise observations where the number of directors who did not attend is either at least one or zero.

These results are reported in Table 9, presenting various models examining the relation between managerial narrative and future stock price crashes under the different subsamples. Interestingly, the results show a prevalent managerial narrative−crash relation across all subsamples, regardless of the condition considered. This evidence suggests that internal corporate governance does not affect the observed relation. The results feature a contradiction with prior studies highlighting the importance of internal corporate governance in mitigating the adverse effect of crash determinants. Particularly, our findings support the notion that traditional internal governance mechanisms are not effective in monitoring how man-

agerial rhetoric influences information flow to investors. In this vein, boards should consider implementing more robust oversight systems to identify and control the use of managerial narratives as a tool for shaping investor perceptions.

[Insert Table 9, here]

5 Identifying Cheap Talk in Managerial Rhetoric

In this section we seek to identify instances of *cheap talk* within managerial rhetoric and relate them to future corporate innovation outcomes. The concept of cheap talk refers to narrative disclosures that lack substantive backing and are primarily aimed at influencing perceptions rather than reflecting actionable strategies or tangible outcomes. These fluff disclosures often result in misaligned market expectations and potential shareholder detriment.

Managers may easier leverage cheap talk—optimistic but unverifiable disclosures—about uncertain outcomes, to inflate investor expectations. Such practices may be strategically used to amplify stock prices beyond their intrinsic values, ultimately leading to sharp corrections when these expectations remain unmet, sometimes at the expense of long-term shareholder value (Shiller, 2020; Frankel et al., 2010). MD&A disclosures are particularly susceptible to such exploitation. Unlike audited financial statements, MD&A narratives offer managers considerable discretion in their content and tone. Consequently, their qualitative nature and lack of strict regulatory oversight can create opportunities for fluff disclosures aimed at hyping expectations (Balvers et al., 2016; Bushee et al., 2022).

This phenomenon is particularly pronounced in the context of R&D disclosures, since innovation is inherently uncertain and difficult to quantify, making it a fertile ground for managerial opportunism (Merkley, 2014; Haddad et al., 2022). Forward-looking R&D narratives allow managers to signal innovation potential, even in the absence of substantive action or evidence. When these optimistic disclosures are followed by stock price crashes, it raises questions about the authenticity of the narratives and signals the presence of cheap

talk.

In this context, we hypothesize that a positive change in narrative disclosure regarding R&D, followed by an increase in stock price crash risk, signals rhetoric that is more likely to be superficial or misaligned with actual firm outcomes. The absence of subsequent tangible outcomes, such as advancements in innovation, supports this interpretation. To test this hypothesis, we include an interaction term between positive changes in R&D narrative disclosures and stock price crash risk one year ahead in our regression model. This interaction serves as an indicator of cheap talk, allowing us to evaluate its relationship with future innovation performance. Specifically, we examine its relationship with four key measures: the cumulative number of patents and the cumulative value of patents over the subsequent three years, as well as their weighted averages. These metrics capture both the quantity and quality of innovative output, providing a robust assessment of managerial follow-through.

In order to distinguish cheap talk from actual intention for innovation that may result in tangible actions, we include additional explanatory variables in our models to capture the positive change in R&D expenditure and its interaction with the stock price crash. By incorporating this, we aim to differentiate between rhetoric that might simply be a communication tool (cheap talk) and actual intentions for future innovation. We hypothesize that positive changes in R&D expenditure signal a genuine commitment to innovation and are likely to translate into real actions. When a firm increases its R&D spending, it can be interpreted as a signal of their intention to pursue innovative activities. Therefore, we expect that the market perceives this positive change as an indicator of future growth.

To further explore this, we also examine the interaction between the positive change in R&D and the occurrence of a stock price crash. The underlying assumption here is that during a stock price crash, investors may normally penalize firms if there are doubts about the firm's ability to deliver on its promises. However, when R&D expenditure is positively changing, we expect that investors may not penalize the firm as heavily. This is because the increase in R&D is viewed as a tangible action toward future innovation, signaling the firm's

commitment to long-term growth rather than just relying on narrative rhetoric. Thus, by comparing the effects of cheap talk and positive R&D changes on future innovation, we aim to discern whether the firm's narrative and actual strategic moves are perceived differently by the market.

The results presented in Table 10 illustrate the effect of cheap talk on future patent outputs and innovation performance. The dependent variables include Cumulative Patents, Weighted Average of Cumulative Patents, Cumulative Value of Patents, and Weighted Average of the Cumulative Value of Patents, measured over a three years period. The findings show that Cheap Talk consistently exhibits a significant negative effect across different models, indicating that cheap talk, or rhetorical statements without substantial action are confirmed by weaker future innovation outputs. In contrast, Positive Change in Narrative $FLS-MD\&A$ has a positive relationship with innovation outcomes, suggesting that positive changes in managerial rhetoric are associated with higher future innovation, as these may be associated with cases of communication for fostering innovation. The Crash variable generally does not show a significant effect when analyzed independently, with coefficients close to zero and not statistically significant, suggesting that it does not significantly influence future patent outputs. On the other hand, Positive Change in R&D demonstrates a positive and statistically significant effect on future patent outputs, indicating that increases in R&D expenditure or activity positively impact future innovation performance. However, the interaction between Positive Change in R&D and Crash is not significant, meaning that the stock price crash does not substantially modify the relationship between positive changes in R&D and future innovation outputs, confirming our expectations.

Overall, the analysis reveals a negative relationship between cheap talk and future patent outcomes. Firms exhibiting a stock price crash risk after positive narrative changes in R&D tend to have lower cumulative number of patents and diminished patent value over the next three years. This finding substantiates the presence of cheap talk, highlighting that inflated narrative disclosures often fail to translate into meaningful innovation. These results

have important implications for understanding the role of managerial rhetoric in shaping market perceptions. By identifying cheap talk, this study underscores the potential risks of overreliance on optimistic disclosures without verifying their alignment with concrete actions. Investors and policymakers should consider mechanisms to mitigate such risks, ensuring that managerial narratives are held accountable to measurable outcomes.

[Insert Table 10, here]

6 Conclusions

A growing body of literature has focused on rationalizing stock price crashes through the hoarding of bad news mechanism, placing an overly emphasis on the agency-based channel of opacity and, to a lesser extent, overinvestment. Nonetheless, recent evidence suggests that the opacity- and overinvestment-crash relations are non-significant, especially in the period following the enforcement of the Sarbanes–Oxley Act. Possibly, this occurs because the period following the Sarbanes-Oxley Act has seen a surge in corporate governance regulations, laws, and exchange listing standards that hold executives accountable for the accuracy and credibility of the information they disclose to investors and the public.

Admittedly, whilst managers may risk allegations of using creative accounting techniques to obfuscate a firm's financial standing, they are not legally liable for setting unrealized expectations through their managerial narratives. In this spirit, we present evidence that managerial rhetoric acts as an important channel for managers to convey anticipated favorable soft information to investors. This mechanism serves as a protective measure to shield executives from potential legal liability, while also minimizing the risk of litigation arising from potentially misleading numerical disclosures in financial statements. Consequently, when the information disclosed is inconsistent with the subsequent performance and the preestablished expectations, investors abruptly revise their expectations and causing extreme sudden declines in idiosyncratic returns. Ergo, the managerial rhetoric mechanism emerges

as a powerful communication tool that self-interested executives may strategically exploit to hype investor expectations at unjustifiable levels and inflate a firm's stock price beyond its intrinsic value at the expense of shareholders.

Our findings suggest that narrative disclosures describing forward-looking R&D activities, sourced from the MD&A section of 10-K filings, are positively associated with future stock price crash risk and become stronger in subsample restricted only to firms with non-missing R&D expenditures. The results remain robust when controlling for prominent textual variables. In testing alternative explanations of our findings, we incorporate different proxies of R&D activity narratives to control for actual innovation activity, alternative hoarding of bad news mechanism measures and equity-based incentives. Overall, the results withstand these prominent controls proposed in prior studies and suggest the existence of an alternative, yet important, conduit that enables managers to portray a more favorable outlook for their firms' prospects.

Moreover, our findings feature the importance of the external mechanisms that urge CEOs to utilize the managerial rhetoric mechanism to self-control the flow of information to the investment community. In particular, the results show that the adverse impact of managerial narrative prevails among firms that face high competition, firms with managers that are not entrenched and firms covered by analysts. Moreover, the results demonstrate the inefficacy of internal corporate governance to identify the utilization of the managerial rhetoric mechanism, and accordingly its failure to offset any risks that may be associated with exploiting the management discussion at the expense of shareholders. In summary, our findings provide a plausible reason for the utilization of the conduit for delivering self-serving information, when external pressure put at risk the management's empire.

Finally, this study underscores the importance of identifying cheap talk within managerial rhetoric and its detrimental impact on future innovation outcomes. By isolating instances where optimistic R&D narratives lack substantive backing and be accompanied by a subsequent stock price crash, we reveal how such disclosures can mislead market expectations.

Conversely, our findings highlight the value of tangible R&D investments as credible signals of commitment to innovation, offering critical insights for investors and policymakers in discerning rhetoric from actionable strategy. Overall, our findings underscore the existence of a mechanism that managers exploit to hype investors' expectations and inflate stock prices.

References

Aboody, D., Lev, B., 2000. Information asymmetry, R&D, and insider gains. *The Journal of Finance* 55(6), 2747–2766.

Ahern, K. R., Sosyura, D., 2014. Who writes the news? Corporate press releases during merger negotiations. *The Journal of Finance* 69(1), 241–291.

Akerlof, G., Snower, D., 2016. Bread and bullets. *Journal of Economic Behavior & Organization* 126, 58–71.

Al Mamun, M., Balachandran, B., Duong, H. N., 2020. Powerful CEOs and stock price crash risk. *Journal of Corporate Finance* 62, 101582.

Altman, E., 1968. Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance* 23(4), 589–609.

American Institute of Certified Public Accountants' (AICPA), 2010. MD&A reporting-enhanced business reporting consortium. Corporate Finance Insider (Dec 10.).

Amernic, J., Craig, R., Tourish, D., 2010. Measuring and assessing tone at the top using annual report CEO letters. The Institute of Chartered Accountants in Scotland Edinburgh.

Andreou, P. C., Antoniou, C., Horton, J., Louca, C., 2016. Corporate governance and firm-specific stock price crashes. *European Financial Management* 22(5), 916–956.

Andreou, P. C., Drivas, K., Philip, D., Wood, G., 2024. Technology Rhetoric and Institutional Ownership. *Forthcoming in Cambridge Journal of Economics* .

Andreou, P. C., Lambertides, N., Magidou, M., 2020. CEO Departure and Stock Price Crashes: The Effects of Crepuscular Behavior. *Available at SSRN 3654478* .

Andreou, P. C., Lambertides, N., Magidou, M., 2023. A critique of the agency theory viewpoint of stock price crash risk: The opacity and overinvestment channels. *British Journal of Management* 34, 2158–2185.

Andreou, P. C., Louca, C., Petrou, A. P., 2017. CEO age and stock price crash risk. *Review of Finance* 21(3), 1287–1325.

Ashbaugh-Skaife, H., Collins, D., LaFond, R., 2006. The effects of corporate governance on firms' credit ratings. *Journal of Accounting and Economics* 42(1-2), 203–243.

Athanasakou, V., Hussainey, K., 2014. The perceived credibility of forward-looking performance disclosures. *Accounting and Business Research* 44(3), 227–259.

Baber, W. R., Fairfield, P. M., Haggard, J. A., 1991. The effect of concern about reported income on discretionary spending decisions: The case of research and development. *Accounting Review* pp. 818–829.

Balvers, R. J., Gaski, J. F., McDonald, B., 2016. Financial disclosure and customer satisfaction: do companies talking the talk actually walk the walk? *Journal of Business Ethics* 139, 29–45.

Bange, M. M., De Bondt, W. F., 1998. R&D budgets and corporate earnings targets. *Journal of Corporate Finance* 4(2), 153–184.

Bartov, E., 1993. The timing of asset sales and earnings manipulation. *The Accounting Review* 68(4), 840–855.

Benmelech, E., Kandel, E., Veronesi, P., 2010. Stock-based compensation and CEO (dis) incentives. *The Quarterly Journal of Economics* 125, 1769–1820.

Bergstresser, D., Philippon, T., 2006. CEO incentives and earnings management. *Journal of Financial Economics* 80(3), 511–529.

Bernard, A. B., Jensen, J. B., Redding, S. J., Schott, P. K., 2007. Firms in international trade. *Journal of Economic Perspectives* 21(3), 105–130.

Bhagat, S., Bolton, B., 2013a. Director ownership, governance, and performance. *Journal of Financial and Quantitative Analysis* 48, 105–135.

Bhagat, S., Bolton, B., 2013b. Director ownership, governance, and performance. *Journal of Financial and Quantitative Analysis* 48, 105–135.

Breton, G., Stolowy, H., 2004. Accounts Manipulation: A Literature Review and Proposed Conceptual Framework. *Review of Accounting and Finance* 3(1), 5–66.

Bryan, S. H., 1997. Incremental information content of required disclosures contained in management discussion and analysis. *The Accounting Review* 72, 285–301.

Bushee, B., Taylor, D. J., Zhu, C., 2022. The dark side of investor conferences: Evidence of managerial opportunism. *The Accounting Review, Forthcoming* .

Bushee, B. J., 1998. The influence of institutional investors on myopic R&D investment behavior. *Accounting Review* pp. 305–333.

Callen, J. L., Fang, X., 2013. Institutional investor stability and crash risk: Monitoring versus short-termism? *Journal of Banking & Finance* 37(8), 3047–3063.

Callen, J. L., Fang, X., 2015. Short interest and stock price crash risk. *Journal of Banking & Finance* 60, 181–194.

Campbell, J., Hilscher, J., Szilagyi, J., 2008. In search of distress risk. *The Journal of finance* 63(6), 2899–2939.

Campbell, T. C., Gallmeyer, M., Johnson, S. A., Rutherford, J., Stanley, B. W., 2011. CEO optimism and forced turnover. *Journal of Financial Economics* 101, 695–712.

Cazier, R. A., Merkley, K. J., Treu, J. S., 2020. When are firms sued for qualitative disclosures? Implications of the safe harbor for forward-looking statements. *The Accounting Review* 95, 31–55.

Cañibano, L., Garcia-Ayuso, M., Sánchez, P., 2000. Accounting for intangibles: a literature review. *Journal of Accounting literature* 19, 102–130.

Chan, W. S., 2003. Stock price reaction to news and no-news: drift and reversal after headlines. *Journal of Financial Economics* 70(2), 223–260.

Chen, J., Hong, H., Stein, J. C., 2001. Forecasting crashes: Trading volume, past returns, and conditional skewness in stock prices. *Journal of Financial Economics* 61(3), 345–381.

Cheng, S., 2004. R&D expenditures and CEO compensation. *The Accounting Review* 79(2), 305–328.

Cohen, D. A., Zarowin, P., 2010. Accrual-based and real earnings management activities around seasoned equity offerings. *Journal of Accounting and Economics* 50, 2–19.

Cole, C. J., Jones, C. L., 2005. Management discussion and analysis: A review and implications for future research. *Journal of Accounting Literature* 24, 135.

Coles, J., Daniel, N., Naveen, L., 2008. Boards: Does One size fit All? *Journal of Financial Economics* 87, 329–356.

Company, M. ., 2018. *The Board Perspective: A Collection of McKinsey Insights Focusing on Boards of Directors*. Tech. rep., McKinsey Global Institute.

Dang, V., Lee, E., Liu, Y., Zeng, C., 2018. Corporate debt maturity and stock price crash risk. *European Financial Management* 24, 451–484.

Davis, A. K., Piger, J. M., Sedor, L. M., 2012. Beyond the numbers: Measuring the information content of earnings press release language. *Contemporary Accounting Research* 29(3), 845–868.

Davis, A. K., Tama-Sweet, I., 2012. Managers' use of language across alternative disclosure outlets: earnings press releases versus MD&A. *Contemporary Accounting Research* 29(3), 804–837.

Dechow, P. M., Dichev, I. D., 2002. The quality of accruals and earnings: The role of accrual estimation errors. *The Accounting Review* 77, 35–59.

Dechow, P. M., Ge, W., Larson, C. R., Sloan, R. G., 2011. Predicting material accounting misstatements. *Contemporary Accounting Research* 28, 17–82.

Dechow, P. M., Sloan, R. G., Sweeney, A. P., 1995. Detecting earnings management. *Accounting Review* 70(2), 193–225.

DeFond, M., Zhang, J., 2014. A review of archival auditing research. *Journal of Accounting and Economics* 58, 275–326.

DeFond, M. L., Hung, M., Li, S., Li, Y., 2015. Does mandatory IFRS adoption affect crash risk? *The Accounting Review* 90, 265–299.

Demers, E., Vega, C., 2010. Soft information in earnings announcements: News or noise? *Journal of Accounting Research* 48(4), 811–846.

Dimitrov, V., Jain, P. C., 2011. It's showtime: Do managers report better news before annual shareholder meetings? *Journal of Accounting Research* 49(5), 1193–1221.

Duchin, R., Ozbas, O., Sensoy, B. A., 2010. Costly external finance, corporate investment, and the subprime mortgage credit crisis. *Journal of Financial Economics* 97(3), 418–435.

Epstein, M. J., Palepu, K. G., 1999. What financial analysts want. *Strategic Finance* 80(10), 48–53.

Erdem, E., Tybout, J. R., 2003. Trade policy and industrial sector responses: Using evolutionary models to interpret the evidence. NBER.

Ertugrul, M., Lei, J., Qiu, J., Wan, C., 2017. Annual report readability, tone ambiguity, and the cost of borrowing. *Journal of Financial and Quantitative Analysis* 52(2), 811–836.

Fama, E. F., French, K. R., 1997. Industry costs of equity. *Journal of Financial Economics* 43(2), 153–193.

Fich, E. M., Shivdasani, A., 2006. Are busy boards effective monitors? *The Journal of Finance* 61(2), 689–724.

Francis, J., Schipper, K., Vincent, L., 2002. Expanded disclosures and the increased usefulness of earnings announcements. *The Accounting Review* 77(3), 515–546.

Frankel, R., Mayew, W. J., Sun, Y., 2010. Do pennies matter? Investor relations consequences of small negative earnings surprises. *Review of Accounting Studies* 15, 220–242.

Garcia, D., Hu, X., Rohrer, M., 2023. The colour of finance words. *Journal of Financial Economics* 147(3), 525–549.

Gayle, G.-L., Li, C., Miller, R. A., 2022. Was Sarbanes-Oxley Costly? Evidence from optimal contracting on CEO compensation. *Journal of Accounting Research* 60(4), 1189–1234.

Gormley, T. A., Matsa, D. A., 2014. Common errors: How to (and not to) control for unobserved heterogeneity. *The Review of Financial Studies* 27(2), 617–661.

Gu, L., 2016. Product market competition, R&D investment, and stock returns. *Journal of Financial Economics* 119(2), 441–455.

Haddad, V., Ho, P., Loualiche, E., 2022. Bubbles and the value of innovation. *Journal of Financial Economics* 145(1), 69–84.

Hasan, M. M., Taylor, G., Richardson, G., 2022. Brand capital and stock price crash risk. *Management Science* 68, 7221–7247.

Hassanein, A., Hussainey, K., 2015. Is forward-looking financial disclosure really informative? Evidence from UK narrative statements. *International Review of Financial Analysis* 41, 52–61.

He, G., Lin, T., 2022. Does air pollution impair investment efficiency? *Economics Letters* 215, 110490.

He, G., Ren, H. M., 2022. Are financially constrained firms susceptible to a stock price crash? *The European Journal of Finance, Forthcoming* pp. 1–26.

Hirshleifer, D., Hsu, P.-H., Li, D., 2013. Innovative efficiency and stock returns. *Journal of Financial Economics* 107(3), 632–654.

Hirshleifer, D., Low, A., Teoh, S., 2012. Are overconfident CEOs better innovators? *The journal of finance* 67(4), 1457–1498.

Hirshleifer, D., Peng, L., Wang, Q., 2023. News diffusion in social networks and stock market reactions (No. w30860). Tech. rep., National Bureau of Economic Research.

Huang, X., Teoh, S. H., Zhang, Y., 2014. Tone management. *The Accounting Review* 89(3), 1083–1113.

Hubbard, R. G., 1998. Capital-market imperfections and investment. *Journal of Economic Literature* 36, 193–225.

Hussainey, K., Schleicher, T., Walker, M., 2003. Undertaking large-scale disclosure studies when AIMR-FAF ratings are not available: the case of prices leading earnings. *Accounting and business research* 33(4), 275–294.

Hutton, A. P., Marcus, A. J., Tehranian, H., 2009. Opaque financial reports, R2, and crash risk. *Journal of Financial Economics* 94(1), 67–86.

Jensen, M. C., 1993. The Modern Industrial Revolution, exit, and the failure of Internal Control Systems. *The Journal of Finance* 48, 831–880.

Jia, N., 2018a. Corporate innovation strategy and stock price crash risk. *Journal of Corporate Finance* 53, 155–173.

Jia, N., 2018b. Tournament incentives and stock price crash risk. *Accounting Horizons* 32(3), 101–121.

Jin, L., Myers, S. C., 2006. R2 around the world: New theory and new tests. *Journal of Financial Economics* 79(2), 257–292.

Kallendorf, C., Kallendorf, C., 1985. The figures of speech, ethos, and Aristotle: Notes toward a rhetoric of business communication. *The Journal of Business Communication (1973)* 22(1), 35–50.

Kerlinger, F. N., Lee, H. B., Bhanthumnavin, D., 2000. Foundations of behavioral research: The most sustainable popular textbook. *Journal of Social Development* 13, 131–144.

Khan, M., Watts, R. L., 2009. Estimation and empirical properties of a firm-year measure of accounting conservatism. *Journal of Accounting and Economics* 48, 132–150.

Kim, C., Wang, K., Zhang, L., 2019. Readability of 10-K reports and stock price crash risk. *Contemporary Accounting Research* 36(2), 1184–1216.

Kim, J.-B., Li, Y., Zhang, L., 2011a. CFOs versus CEOs: Equity incentives and crashes. *Journal of Financial Economics* 101(3), 713–730.

Kim, J.-B., Li, Y., Zhang, L., 2011b. Corporate tax avoidance and stock price crash risk: Firm-level analysis. *Journal of Financial Economics* 100(3), 639–662.

Kim, J.-B., Zhang, L., 2016. Accounting conservatism and stock price crash risk: Firm-level evidence. *Contemporary Accounting Research* 33(1), 412–441.

Kim, Y., Li, H., Li, S., 2014. Corporate social responsibility and stock price crash risk. *Journal of Banking & Finance* 43, 1–13.

Kim, Y., Park, M. S., 2012. Are all management earnings forecasts created equal? Expectations management versus communication. *Review of Accounting Studies* 17, 807–847.

Kogan, L., Papanikolaou, D., Seru, A., Stoffman, N., 2017. Technological innovation, resource allocation, and growth. *The Quarterly Journal of Economics* 132(2), 665–712.

Kothari, S. P., Shu, S., Wysocki, P. D., 2009. Do managers withhold bad news? *Journal of Accounting Research* 47, 241–276.

Lev, B., 1999. R&D and capital markets. *Journal of Applied Corporate Finance* 11, 21–35.

Li, F., 2008. Annual report readability, current earnings, and earnings persistence. *Journal of Accounting and Economics* 45(2-3), 221–247.

Li, F., 2010. The information content of forward-looking statements in corporate filings—A naïve Bayesian machine learning approach. *Journal of Accounting Research* 48(5), 1049–1102.

Li, H., 2019. Repetitive Disclosures in the MD&A. *Journal of Business Finance & Accounting* 46, 1063–1096.

Li, S., Zhan, X., 2019a. Product market threats and stock crash risk. *Management Science* 65(9), 4011–4031.

Li, S., Zhan, X., 2019b. Product market threats and stock crash risk. *Management Science* 65(9), 4011–4031.

Li, Y., Zeng, Y., 2019. The impact of top executive gender on asset prices: Evidence from stock price crash risk. *Journal of Corporate Finance* 58, 528–550.

Lin, B.-W., Lee, Y., Hung, S.-C., 2006. R&D intensity and commercialization orientation effects on financial performance. *Journal of business research* 59, 679–685.

Lin, H., 2012. Cross-sector alliances for corporate social responsibility partner heterogeneity moderates environmental strategy outcomes. *Journal of Business Ethics* 110, 219–229.

Loughran, T., McDonald, B., 2011. When is a liability not a liability? Textual analysis, dictionaries, and 10-Ks. *The Journal of Finance* 66(1), 35–65.

Matsumoto, D., Pronk, M., Roelofsen, E., 2011. What makes conference calls useful? The information content of managers' presentations and analysts' discussion sessions. *The Accounting Review* 86(4), 1383–1414.

Mayew, W. J., Venkatachalam, M., 2012. The power of voice: Managerial affective states and future firm performance. *The Journal of Finance* 67, 1–43.

Merkley, K. J., 2014. Narrative disclosure and earnings performance: Evidence from R&D disclosures. *The Accounting Review* 89(2), 725–757.

Michalopoulos, S., Xue, M., 2021. Folklore. *Quarterly Journal of Economics* 136(4), 1993–2046.

Muslu, V., Radhakrishnan, S., Subramanyam, K. R., Lim, D., 2015. Forward-looking MD&A disclosures and the information environment. *Management Science* 61, 931–948.

Neu, D., Warsame, H., Pedwell, K., 1998. Managing public impressions: environmental disclosures in annual reports. *Accounting, Organizations and Society* 23(3), 265–282.

Ni, X., Peng, Q., Yin, S., Zhang, T., 2020. Attention! Distracted institutional investors and stock price crash. *Journal of Corporate Finance* 64, 101701.

O'Kelley R., A. Goodman, M. M., Reynolds, R., 2018. *2019 Global & Regional Trends in Corporate Governance*. Tech. rep., Harvard Law School Forum on Corporate Governance.

Perry, S., Grinaker, R., 1994. Earnings expectations and discretionary research and develop. *Accounting Horizons* 8(4), 43.

Price, S. M., Doran, J. S., Peterson, D. R., Bliss, B. A., 2012. Earnings conference calls and stock returns: The incremental informativeness of textual tone. *Journal of Banking & Finance* 36(4), 992–1011.

Rhoades, S. A., 1993. The Herfindahl-Hirschman Index. *Federal Reserve Bulletin* 79, 188.

Richardson, S., 2006. Over-investment of free cash flow. *Review of Accounting Studies* 11, 159–189.

Roychowdhury, S., 2006. Earnings management through real activities manipulation. *Journal of Accounting and Economics* 42, 335–370.

SEC, 2007. Beginners' Guide to Financial Statements. Accessed: 2023-07-30.

Securities Act Release 33-6234 (SEC), 1980.

Shiller, R. J., 2017. Narrative economics. *American Economic Review* 107(4), 967–1004.

Shiller, R. J., 2020. Narrative economics: How stories go viral and drive major economic events. Princeton University Press.

Short, J. C., Broberg, J. C., Cogliser, C. C., Brigham, K. H., 2010. Construct validation using computer-aided text analysis (CATA) an illustration using entrepreneurial orientation. *Organizational research methods* 13, 320–347.

Tetlock, P. C., Saar-Tsechansky, M., Macskassy, S., 2008. More than words: Quantifying language to measure firms' fundamentals. *The Journal of Finance* 63(3), 1437–1467.

Tucker, J. W., Zarowin, P. A., 2006. Does income smoothing improve earnings informativeness? *The Accounting Review* 81, 251–270.

Wintoki, M. B., 2007. Corporate boards and regulation: The effect of the Sarbanes–Oxley Act and the exchange listing requirements on firm value. *Journal of Corporate Finance* 13, 229–250.

Woeppel, M., 2022. Using Patent Capital to Estimate Tobin's q. *Journal of Financial and Quantitative Analysis* 57, 2929–2967.

Wyatt, A., 2008. What financial and non-financial information on intangibles is value-relevant? A review of the evidence. *Accounting and business Research* 38, 217–256.

Yekini, L. S., Wisniewski, T. P., Millo, Y., 2016. Market reaction to the positiveness of annual report narratives. *The British Accounting Review* 48(4), 415–430.

Appendices

Appendix A. Variable definitions

This Appendix provides definitions for the variables used in our empirical analysis. The specific time periods for measuring each variable are detailed in the captions of the tables. Variables sourced from Compustat are enclosed in parentheses (...), whilst those from CRSP are enclosed in square brackets [...].

Stock price crash risk

CRASH is a binary variable set equal to one if firm j experiences at least one crash week during the fiscal year t, and zero otherwise. A "crash week" occurs when the idiosyncratic weekly return, $R_{j,w}$, is at least λ standard deviations, $\sigma_{j,t}$, below the average idiosyncratic weekly return, $\mu_{j,t}$, in the fiscal year. Specifically, a crash week is defined as $R_{j,w} < \mu_{j,t} - \lambda \times \sigma_{j,t}$, where the idiosyncratic return is calculated as $R_{j,w} = ln\,(1 + \varepsilon_{j,w})$. The residual, $\varepsilon_{j,w}$, is estimated from the expanded market and industry index model regression:

$$r_{j,w} = \alpha + \sum_{i=-1}^{i=1} \beta_{i,j} r_{MKT,w+i} + \sum_{i=-1}^{i=1} \gamma_{i,j} r_{IND,w+i} + \varepsilon_{j,w},$$

where $r_{j,w}$ denotes the weekly return of stock j on week w, $r_{MKT,w}$ denotes the weekly value-weighted market return and $r_{IND,w}$ denotes the weekly Fama and French (1997) value-weighted 48-industry return. Stock weekly returns are calculated using CRSP daily returns $[ret]$, $r_{MKT,w}$ is calculated using the daily return on the CRSP value-weighted market return with dividends $[vwretd]$, whilst $r_{IND,w}$ is calculated using the daily stock returns $[ret]$ in the CRSP universe. For estimating the residuals, we require a minimum number of 26 weekly return observations.

Narrative disclosures

Narrative$-x$ represents the percentage of sentences containing R&D-related keywords shown in Appendix B, where x designates the specific source of information used for estimation. Accordingly, $x \in \{MD\&A,\ RF,\ 10K\}$, where $MD\&A$ indicates that the information is sourced from the 10-K's Management's Discussion and Analysis section, RF indicates that the information is sourced from the 10-K's risk factors section, and $10K$ indicates that information is sourced from the entire 10-K filing.

Narrative FLS$-x$ represents the percentage of sentences containing R&D-related keywords combined with forward-looking statements (FLS). The dictionary featuring the R&D-related keywords is shown in Appendix B, whilst FLS contains the dictionaries of forward looking statements proposed by Li (2010), Muslu et al. (2015), Matsumoto et al. (2011), Athanasakou and Hussainey (2014), Hussainey et al. (2003), Hassanein and Hussainey (2015), such as: "*will*," "*could*," "*should*," "*expect*," "*anticipate*," "*plan*," "*hope*," "*believe*," "*can*," "*may*," "*might*," "*intend*," "*project*," "*forecast*," "*objective*" and "*goal*".

The full dictionary featuring the forward looking-related keywords is shown in Appendix B. The specific source of information used for estimation is designated by x. Accordingly, $x \in \{MD\&A, RF, 10K\}$, where $MD\&A$ indicates that the information is sourced from the 10-K's Management's Discussion and Analysis section, RF indicates that the information is sourced from the 10-K's risk factors section, and $10K$ indicates that information is sourced from the entire 10-K filing.

Narrative FLS−MD&A is measured as a 3-year weighted average of the forward-looking narrative disclosures of R&D activities within the MD&A section as per *Eqs.* (6) and (7), using $\lambda = 2^{-1/3}$ which results in a weighting scheme of 41.3%, 32.7% and 26%.

Baseline controls

Sentiment−x is the percentage of the difference between the positive words and the negative words (following the Loughran and McDonald, 2011 dictionary), where x designates the specific source of information used for estimation. Accordingly, $x \in \{MD\&A, RF, 10K\}$, where $MD\&A$ indicates that the information is sourced from the 10-K's Management's Discussion and Analysis section, RF indicates that the information is sourced from the 10-K's risk factors section, and $10K$ indicates that information is sourced from the entire 10-K filing.

Size is the natural logarithm of total assets (at).

Firm Age is the number of years that the firm is covered in the Compustat universe.

Market to Book is the market value ($prcc\_f \times csho$) divided by the book value of equity (ceq).

Leverage is total liabilities (lt) divided by total assets (at).

Return on Assets is income before extraordinary items (ib) divided by total assets (at).

Return on Equity is income before extraordinary items (ib) divided by the book value of equity (ceq).

Stock Return is the average idiosyncratic weekly return during the fiscal year.

Detrended Turnover is the detrended average weekly stock trading volume [vol] during the fiscal year.

Zscore is the fitted value using the original coefficients of the model proposed by Altman (1968).

Ncskew is the negative of the third moment of firm's j idiosyncratic weekly returns ($R_{j,w}$) divided by the standard deviation of idiosyncratic weekly returns raised to the third power, defined as:

$$Ncskew_{j,t} = -\Big(n(n-1)^{3/2}\sum_{w=1}^{n} R_{j,w}^3\Big) / \Big((n-1)(n-2)(\sum_{w=1}^{n} R_{j,w}^2)^{3/2}\Big),$$

where n is the number of weekly returns during fiscal year t. All quantities involved in the

estimation of *Ncskew* are consistent with those outlined in the *CRASH* definition.

Ceo Depart is a binary variable set equal to one if there is a CEO departure in firm's CEO, during the fiscal year t, and zero otherwise.

Innovation activity and efficiency

R&D Sale is research and development expense (xrd) divided by total sales ($sale$).

R&D Assets is research and development expense (xrd) divided by total assets (at).

Patents Cites is the number of firm's patents granted weighted with their citations. To determine the U.S. patents associated with each firm, we utilize the matched data set introduced by Kogan, Papanikolaou, Seru, and Stoffman (2017).

Innovation Efficiency (*R&D-Capital*) is the number of patents granted scaled by $R\&D$ (xrd) capital, whereby $R\&D$ capital is the 5-year cumulative $R\&Dexpenditure$, following Hirshleifer et al. (2013). To determine the U.S. patents associated with each firm, we utilize the matched dataset introduced by Kogan et al. (2017).

Innovation Efficiency (*Cites-R&D-Capital*) is the number of patents granted weighted with their citations scaled by R&D ($R\&D$) capital, whereby R&D capital is the 5-year cumulative R&D expenditure, following Hirshleifer et al. (2013). To determine the U.S. patents associated with each firm, we utilize the matched dataset introduced by Kogan et al. (2017).

Exploitative is the percentage of exploitative patents relatively to the number of all patents filed by the firm in the same year, where a patent is classified as exploitative if at least 60% of its citations are based on existing knowledge, following Jia (2018a).

Explorative is the percentage of exploratory patents relatively to the number of all patents filed by the firm in the same year, where a patent is classified as exploratory if at least 60% of its citations are based on new knowledge, following Jia (2018a).

Overconfidence is a binary variable set equal to one if the CEO is classified as overconfident based on their tendency to hold options deep in the money (greater than 100%), otherwise 0, following Campbell et al. (2011).

Hoarding of bad news

Opacity is the three-year moving sum of the absolute value of discretionary accruals ($DACC$), following Hutton et al. (2009). $DACC$ is obtained from a modified Jones model as $DACC_t = TA_t/ASSETS_{t-1} - (a_0(1/ASSETS_{t-1}) + b_1(\Delta SALES_t - \Delta RECEIVABLES_t)/ASSETS_{t-1} + b_2(PPE_t/ASSETS_{t-1}))$, where total accruals ($TA$) is obtained from the following cross-sectional regression equation using the firms in each Fama and French 48 industries for each fiscal year as $TA_t/ASSETS_{t-1} = a_0(1/ASSETS_{t-1}) + b_1(\Delta SALES_t/ASSETS_{t-1}) + b_2(PPE_t/ASSETS_{t-1}) + e_t$, where TA is total accruals, $ASSETS$ is total assets (at), $\Delta SALES$ is change in sales ($sale$), $\Delta RECEIVABLES$ is change in receivables (rec) and PPE is property, plant, and equipment (ppe).

Overinvestment is measured following the approach developed by Richardson (2006), using Tobin's Q as the proxy for growth opportunities, augmented by the industrial sales growth rate, in the spirit of He and Lin (2022) .

Depreciation is the depreciation expense (xdp) divided by sales ($sale$).

R&D Cut is a binary variable set equal to one if a firm experiences a negative change in research and development expenditure (xrd) relative to the prior year, and zero otherwise.

CEO incentives

Stock Incentives is the CEO stock holdings incentives ratio estimated as in Bergstresser and Philippon (2006).

Option Incentives is the CEO option holdings incentives ratio estimated as in Bergstresser and Philippon (2006).

External corporate governance

Competitiveness is the sum of the square market share of all the firms in an industry (where the market share refers to the sales ($sale$) of the firm over the total sales of all firms in each industry), following Rhoades (1993).

Entrenchment Index is the number of extra titles the CEO holds (the CEO receives one extra point for chair or president, one for founder and one if it also holds the title of CFO or COO), following Al Mamun et al. (2020).

Analysts is the total number of analysts covering the firm.

Board composition and characteristics

Board Size is total number of directors on the board.

Independent Directors is the number independent directors on the board.

Female Directors is the number of female directors on the board.

Busy Directors is the number of directors who are also members of other Major Company Boards.

Not Attended Directors is the number of directors who attended less than 75% of the board meetings.

Identifying Cheap Talk

Cumulative Patents is the number of firm's patents granted over a three-year period. To determine the U.S. patents associated with each firm, we utilize the matched data set introduced by Kogan et al. (2017).

Weighted Average of Cumulative Patents is the number of firm's patents granted over a three-year period using a weighting scheme of 41.3%, 32.7% and 26%. To determine the U.S.

patents associated with each firm, we utilize the matched data set introduced by Kogan et al. (2017).

Cumulative Value of Patents is the value of firm's patents granted over a three-year period. To determine the value patents associated with each firm, we utilize the publicly available data set introduced by Woeppel (2022).

Weighted Average of Cumulative Value of Patents is the value of firm's patents granted over a three-year period using a weighting scheme of 41.3%, 32.7% and 26%. To determine the value patents associated with each firm, we utilize the publicly available data set introduced by Woeppel (2022).

Positive Change in Narrative FLS−MD&A is a binary variable set equal to one if firm j experiences a positive change in *Narrative FLS−MD&A* from the fiscal year $t-1$ to the fiscal year t, and zero otherwise.

Positive Change in R&D is a binary variable set equal to one if firm j experiences a positive change in *R&D Assets* from the fiscal year $t-1$ to the fiscal year t, and zero otherwise.

Cheap Talk is a binary variable set equal to one if firm j experiences both a *Positive Change in Narrative FLS−MD&A* and a *Crash* in fiscal year t, and zero otherwise.

Crash with Positive Change in R&D is a binary variable set equal to one if firm j experiences both a *Positive Change in R&D* and a *Crash* in fiscal year t, and zero otherwise.

Appendix B. Dictionaries

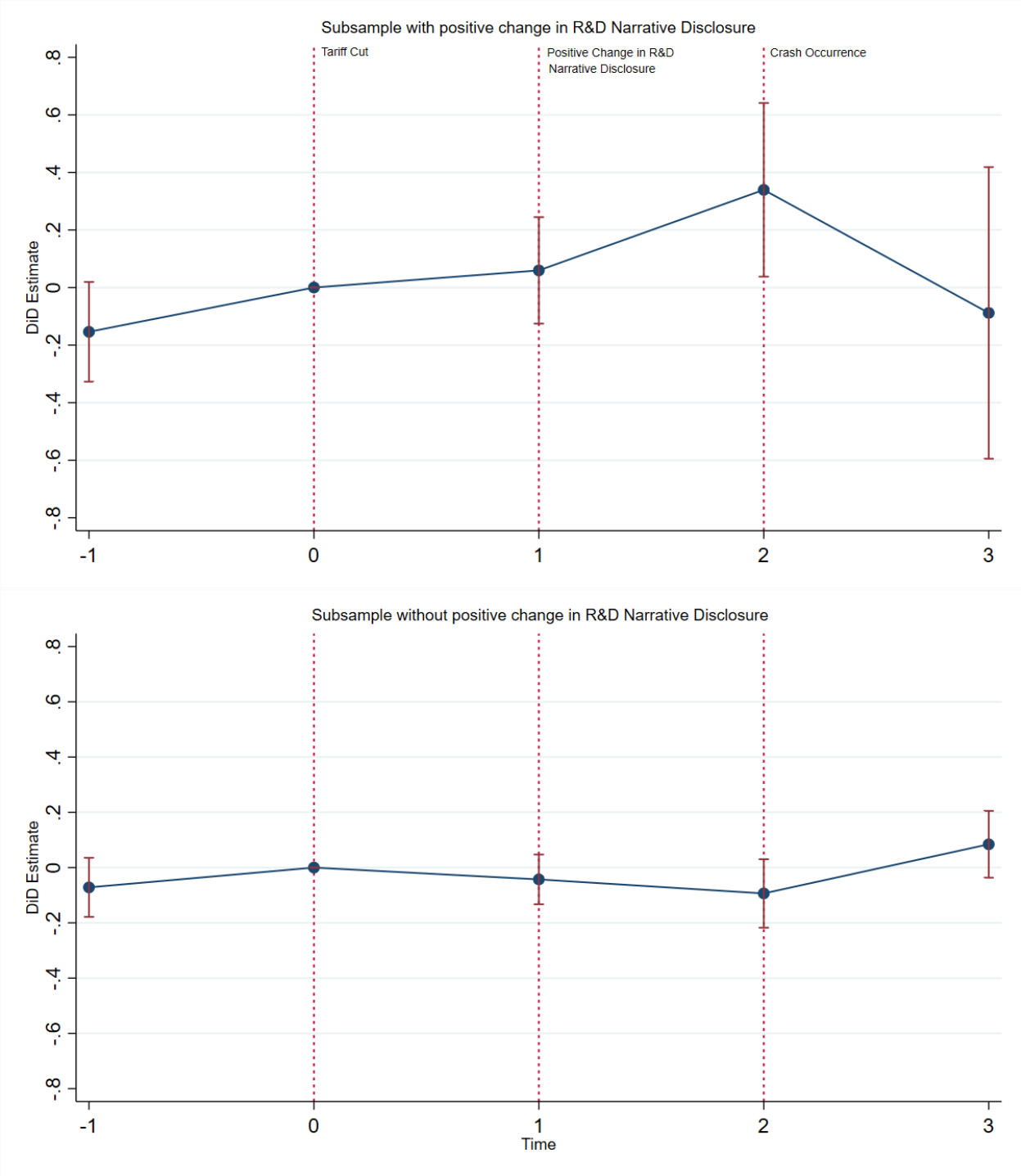
This appendix provides the list of keywords and phrases used in this study. In terms of the narrative R&D keywords and phrases used to classify a sentence as an R&D-related disclosure, we utilize Merkley (2014)'s dictionary with a slight modification, involving the addition of plural or singular forms and third person of the lexical tokens present in the original version. To classify a sentence as a forward looking-related disclosure, we use a set of forward-looking keywords and phrases derived from a combination of dictionaries proposed by Li (2010), Muslu et al. (2015), Matsumoto et al. (2011), Athanasakou and Hussainey (2014), Hussainey et al. (2003), Hassanein and Hussainey (2015).

List of R&D keywords and phrases
announced/es a collaboration/s; application/s pending; applied for patent/s; applies for a patent/s; breakthrough innovation; breakthrough/s in; claims in this/these patent/s; clinical candidate/s; clinical data; clinical development/s; clinical program/s; clinical study/ies; collaborative initiative/s; collaborative research/es; completion of key milestones; completes key milestones; conduct/s research; continuing development of; continues development of; develop technology/ies; developing new product/s; developing new technology/ies; development of new product/s; development of proprietary technology/ies; develops new products; develops products; develops proprietary technology/ies; develops technology/ies; drug candidate/s; entering development; enters development; established a collaboration/s; establishes a collaboration/s; evaluating the potential of; evaluates the potential of; filed patent/s; files a patent/s; grants a patent/s; granted a patent/s; important patent/s; issued a patent/s; issues a patent/s; joint research/es; joint venture/s to develop; key patent/s; new patent/s; new technology/ies; patent/s pending; patent/s was/were awarded; pilot study/ies; preclinical data; preclinical development/s; product candidate/s; product development; product engineering; project/s in development; received a patent/s; receives a patent/s; research and development; research and evaluation project; research and product development; research center/s; research collaboration/s; research collaborative/s; research, development; research, engineering, and development; researches and develops; researches and develops products; researches and evaluates projects; researches, develops; researches, engineers, and develops; research/es development/s; research facility/ies; research initiative/s; research operation/s; research pipeline/s; research program/s; research project/s; research venture/s; R&D; safety study/ies; technical development/s; technological breakthrough/s; technology breakthrough/s; technology development/s; technology milestone/s.

List of forward-looking keywords and phrases
accelerate/s; aim/s; anticipate/s; await/s; be; believe/s; can; coming; confidence; confident; convince/s; could; current; envisage/s; estimate/s; eventual; expect/s; following; forecast/s; forthcoming; future; goal; going forward; go/es forward; hope/s; incoming; intend/s; intends; intention; likely; look/s ahead; look/s forward; look-ahead; look-forward; looking ahead; looking forward; may; might; next; novel; objective; optimistic; outlook; plan/s; planned; planning; predict/s; project/s; prospect/s; remain/s; renew/s; scope for; scope to; seek/s; shall; shortly; should; soon; subsequent; subsequently; unlikely; upcoming; well placed; well positioned; well-placed; well-positioned; will; would; year/s ahead; year/s-ahead.

Figures

Figure 1. DiD Estimators - dynamic design
This figure depicts the results of the DiD estimators from the dynamic design for two subsamples: one with a positive change in R&D narrative disclosure (first) and the other without (second). The tariff cut serves as the treatment, and the stock price crash is the outcome.



Tables

Table 1. Summary statistics

This table presents summary statistics for key variables over the period 1994-2021. These statistics are obtained using a sample with sufficient data to estimate the main variables, consisting of 1,996 firms with 16,752 firm-year observations. The *CRASH* variable is measured in fiscal year $t+1$, whereas all the other variables are measured in fiscal year t. All continuous variables are winsorized at the 1st and 99th percentile. For variable definitions and details of their calculation, see Appendix A.

Variable	Mean	Std. Dev.	Q1	Median	Q3
Panel A: Dependent variable					
CRASH	0.249	0.433	0.000	0.000	0.000
Panel B: Explanatory variables					
Narrative FLS-MD&A	0.586	1.127	0.000	0.111	0.688
Narrative-MD&A	1.911	3.601	0.000	0.483	2.546
Panel C: Baseline control variables					
Sentiment-MD&A	−0.832	0.585	−1.198	−0.780	−0.423
Total Assets	6241.8	14553.2	512.9	1500.0	4675.3
Firm Age	25.440	17.107	12.000	20.000	35.000
Market to Book	3.476	5.107	1.464	2.396	4.054
Leverage	0.517	0.237	0.345	0.518	0.661
Return on Assets	0.033	0.113	0.010	0.048	0.086
Return on Equity	0.070	0.438	0.021	0.105	0.182
Stock Return	0.053	0.196	−0.060	0.044	0.155
Detrended Turnover	0.001	0.021	−0.008	0.000	0.008
Zscore	1.040	0.728	0.589	0.890	1.275
Ncskew	0.027	0.827	−0.457	−0.034	0.437
CEO Depart	0.110	0.313	0.000	0.000	0.000

Table 2. Correlation coefficients matrix

This table presents the Pearson correlation coefficients matrix for key variables over the period 1994-2021. The coefficients are obtained using a sample with sufficient data to estimate the main variables, consisting of 1,996 firms with 16,752 firm-year observations. The *CRASH* variable is measured in fiscal year $t+1$, whereas all the other variables are measured in fiscal year t. All continuous variables are winsorized at the 1st and 99th percentile. For variable definitions and details of their calculation, see Appendix A. The symbols ***, **, and * denote two-tailed statistical significance at the 1%, 5%, and 10% level, respectively.

Variables	CRASH	Narrative FLS-MD&A	Narrative-MD&A	Sentiment-MD&A	Total Assets	Firm_Age	Market to Book	Leverage	Return on Assets	Return on Equity	Stock Return	Dturn	Zscore	Ncskew	CEO Depart
CRASH	1														
Narrative FLS-MD&A	0.035***	1													
Narrative-MD&A	0.035***	0.874***	1												
Sentiment-MD&A	0.017**	0.114***	0.171***	1											
Total Assets	−0.033***	−0.264***	−0.267***	−0.053***	1										
Firm Age	−0.023***	−0.190***	−0.183***	−0.046***	0.410***	1									
Market to Book	0.019**	0.129***	0.139***	0.127***	0.015**	−0.014*	1								
Leverage	−0.031***	−0.217***	−0.220***	−0.072***	0.408***	0.229***	0.043***	1							
Return on Assets	0.034***	−0.261***	−0.223***	0.190***	0.172***	0.086***	0.121***	−0.147***	1						
Return on Equity	0.014*	−0.135***	−0.124***	0.117***	0.127***	0.075***	0.223***	0.008	0.500***	1					
Stock Return	0.003	0.020**	0.019**	−0.006	−0.036***	−0.018**	0.056***	0.015*	−0.031***	0.007	1				
Detrended Turnover	0.006	−0.030***	−0.018**	0.027***	0.011	0.001	0.023***	0.052***	0.025***	0.015*	0.024***	1			
Zscore	0.029***	−0.227***	−0.215***	0.016**	−0.149***	0.002	0.019**	0.034***	0.176***	0.089***	−0.018**	0.011	1		
Ncskew	0.017**	0.002	0.002	−0.014*	0.005	−0.014*	−0.035***	−0.024***	0.002	−0.007	−0.166***	0.052***	0.018**	1	
CEO Depart	0.008	−0.020**	−0.027***	−0.049***	0.019**	0.028***	−0.023***	0.040***	−0.074***	−0.040***	−0.029***	0.003	0.011	0.044***	1

$***p < 0.01, **p < 0.05, *p < 0.1$

Table 3. The effect of R&D managerial narrative disclosure on future stock price crash risk

This table presents logistic regression estimates examining the relation between R&D managerial narrative disclosure and future stock price crash risk. The estimates of Panel A are obtained using the full sample, whilst the estimates of Panel B are obtained using a sample with non-missing R&D expense data. The dependent variable is *CRASH* in all models, constituting a dichotomous measure of stock price crashes. The dependent variable is measured in fiscal year $t+1$. The main explanatory variables are *Narrative FLS−MD&A*, which measures the percentage of sentences containing forward-looking R&D-related keywords as described in section 2, and *Narrative−MD&A*, which measures the percentage of sentences containing R&D-related keywords, both sourced from the Management's Discussion and Analysis section of the 10-K filing. All explanatory variables are measured in fiscal year t. For variable definitions and details of their calculation, see Appendix A. The estimates include a constant and different fixed effects (as indicated at the bottom of the table) whose coefficients are suppressed. Industry fixed effects are defined based on the Fama–French 48-industry classification. All continuous variables are winsorized at the 1st and 99th percentile and are standardized to have a mean value of zero and variance of one. Robust standard errors clustered at the firm level are shown in parentheses. The symbols ***, **, and * denote two-tailed statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Full data

	(1)	(2)	(3)	(4)	(5)	(6)
Narrative FLS-MD&A	0.081***					
	(0.03)					
Narrative FLS-MD&A (2)		0.081***				
		(0.03)				
Narrative FLS-MD&A (3)			0.080***			
			(0.03)			
Narrative FLS-MD&A (4)				0.081***		
				(0.03)		
Narrative FLS-MD&A★					0.074***	
					(0.02)	
Narrative-MD&A						0.074***
						(0.02)
Sentiment-MD&A	−0.008	−0.008	−0.008	−0.008	−0.007	−0.012
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
ln(Total Assets)	−0.040	−0.040	−0.040	−0.040	−0.040	−0.040
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
ln(Firm Age)	0.001	0.001	0.001	0.001	0.000	−0.001

Continued on the next page

	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Market to Book	0.000	0.000	0.001	0.000	0.001	0.001
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Leverage	−0.012	−0.012	−0.012	−0.012	−0.012	−0.014
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Return on Assets	0.098***	0.098***	0.098***	0.098***	0.096***	0.094***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Return on Equity	−0.008	−0.008	−0.008	−0.008	−0.008	−0.007
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Stock Return	0.024	0.024	0.025	0.024	0.024	0.025
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Detrended Turnover	0.026	0.026	0.026	0.026	0.026	0.025
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Zscore	0.067**	0.067**	0.067**	0.067**	0.066**	0.066**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Ncskew	0.021	0.021	0.021	0.021	0.021	0.021
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
CEO Depart 3Y Before	0.174**	0.174**	0.174**	0.174**	0.173**	0.174**
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
CEO Depart 2Y Before	0.262***	0.261***	0.262***	0.261***	0.260***	0.262***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
CEO Depart 1Y Before	0.331***	0.331***	0.331***	0.331***	0.330***	0.332***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
CEO Depart	0.161***	0.161***	0.161***	0.161***	0.161***	0.162***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
CEO Depart 1Y After	0.022	0.022	0.021	0.022	0.022	0.022
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Fixed effects	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry
Observations	16,752	16,752	16,752	16,752	16,752	16,752
Pseudo Log-Likelihood	−9140.381	−9140.325	−9140.555	−9140.355	−9141.127	−9141.278
Pseudo R-squared	0.028	0.028	0.028	0.028	0.028	0.028

Continued on the next page

Panel B: Data with non-missing R&D expense						
	(1)	(2)	(3)	(4)	(5)	(6)
Narrative FLS-MD&A	0.085***					
	(0.03)					
Narrative FLS-MD&A (2)		0.085***				
		(0.03)				
Narrative FLS-MD&A (3)			0.084***			
			(0.03)			
Narrative FLS-MD&A (4)				0.085***		
				(0.03)		
Narrative FLS-MD&A★					0.075***	
					(0.03)	
Narrative-MD&A						0.070***
						(0.03)
Sentiment-MD&A	0.011	0.011	0.011	0.011	0.012	0.006
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
ln(Total Assets)	−0.058*	−0.058*	−0.058*	−0.058*	−0.059*	−0.059*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
ln(Firm Age)	0.014	0.014	0.014	0.014	0.012	0.011
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Market to Book	0.002	0.002	0.003	0.002	0.003	0.004
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Leverage	−0.002	−0.002	−0.002	−0.002	−0.002	−0.005
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Return on Assets	0.109***	0.109***	0.109***	0.109***	0.106***	0.102***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Return on Equity	−0.014	−0.014	−0.014	−0.014	−0.014	−0.013
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Stock Return	0.055**	0.054**	0.055**	0.054**	0.054**	0.055**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Detrended Turnover	0.015	0.015	0.015	0.015	0.015	0.014
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Zscore	−0.009	−0.009	−0.010	−0.009	−0.012	−0.013

Continued on the next page

	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Ncskew	0.023	0.023	0.023	0.023	0.023	0.023
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
CEO Depart 3Y Before	0.208**	0.208**	0.208**	0.208**	0.207**	0.207**
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
CEO Depart 2Y Before	0.200**	0.200**	0.200**	0.200**	0.198**	0.200**
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
CEO Depart 1Y Before	0.314***	0.314***	0.314***	0.314***	0.312***	0.314***
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
CEO Depart	0.172**	0.172**	0.172**	0.172**	0.170**	0.171**
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
CEO Depart 1Y After	0.048	0.049	0.048	0.049	0.048	0.047
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Fixed effects	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry
Observations	10,692	10,692	10,692	10,692	10,692	10,692
Pseudo Log-Likelihood	−5894.877	−5894.852	−5895.040	−5894.886	−5895.940	−5896.633
Pseudo R-squared	0.030	0.030	0.030	0.030	0.030	0.029

Table 4. The effect of R&D managerial narrative disclosure on future stock price crashes: Evidence from the entire 10-K and Risk Factors section - Placebo Test

This table presents logistic regression estimates examining the relation between R&D managerial narrative disclosure and future stock price crashes. The dependent variable is *CRASH*, constituting a dichotomous measure of stock price crashes in fiscal year $t+1$. The main explanatory variable in Panel A is *Narrative FLS−10K* which measures the percentage of sentences containing forward-looking R&D-related keywords as described in section 2, sourced from the entire 10-K filing. The main explanatory variable in Panel B is *Narrative FLS−RF* which measures the percentage of sentences containing forward-looking R&D-related keywords as described in section 2, sourced from the Risk Factors section of the 10-K filing. All explanatory variables are measured in fiscal year t. For variable definitions and details of their calculation, see Appendix A. The estimates include a constant and different fixed effects (as indicated at the bottom of the table) whose coefficients are suppressed. Industry fixed effects are defined based on the Fama–French 48-industry classification. All continuous variables are winsorized at the 1st and 99th percentile and are standardized to have a mean value of zero and variance of one. Robust standard errors clustered at the firm level are shown in parentheses. The symbols ***, **, and * denote two-tailed statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Estimating the R&D managerial narrative using the entire 10-K filing

	(1)	(2)	(3)	(4)	(5)
Narrative FLS-10K	0.036				
	(0.02)				
Narrative FLS-10K (2)		0.036			
		(0.02)			
Narrative FLS-10K (3)			0.035		
			(0.02)		
Narrative FLS-10K (4)				0.036	
				(0.02)	
Narrative FLS-10K★					0.032
					(0.02)
Sentiment-10K	0.002	0.002	0.002	0.002	0.001
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
ln(Total Assets)	−0.041	−0.041	−0.041	−0.041	−0.041
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
ln(Firm Age)	−0.002	−0.002	−0.002	−0.002	−0.003
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Market to Book	0.006	0.006	0.006	0.006	0.006
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)

Continued on the next page

Leverage	−0.018	−0.018	−0.018	−0.018	−0.019
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Return on Assets	0.088***	0.089***	0.088***	0.089***	0.088***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Return on Equity	−0.010	−0.010	−0.010	−0.010	−0.010
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Stock Return	0.024	0.024	0.024	0.024	0.024
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Detrended Turnover	0.025	0.025	0.025	0.025	0.025
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Zscore	0.060*	0.060*	0.060*	0.060*	0.060*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Ncskew	0.021	0.021	0.021	0.021	0.021
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
CEO Depart 3Y Before	0.172**	0.172**	0.172**	0.172**	0.172**
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
CEO Depart 2Y Before	0.260***	0.260***	0.260***	0.260***	0.260***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
CEO Depart 1Y Before	0.329***	0.329***	0.328***	0.329***	0.328***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
CEO Depart	0.159***	0.159***	0.159***	0.159***	0.159***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
CEO Depart 1Y After	0.019	0.019	0.019	0.019	0.019
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Fixed effects	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry
Observations	16,752	16,752	16,752	16,752	16,752
Pseudo Log-Likelihood	−9144.672	−9144.642	−9144.719	−9144.653	−9144.808
Pseudo R-squared	0.028	0.028	0.028	0.028	0.028

Panel B: Estimating the R&D managerial narrative using the risk factors section

	(1)	(2)	(3)	(4)	(5)
Narrative FLS-RF	0.020				
	(0.02)				
Narrative FLS-RF (2)		0.021			

Continued on the next page

		(0.02)			
Narrative FLS-RF (3)			0.020		
			(0.02)		
Narrative FLS-RF (4)				0.021	
				(0.02)	
Narrative FLS-RF$^{\bigstar}$					0.017
					(0.02)
Sentiment-10K	0.021	0.021	0.021	0.021	−0.002
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
ln(Total Assets)	−0.037	−0.037	−0.037	−0.037	−0.053**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
ln(Firm Age)	−0.001	−0.001	−0.001	−0.001	−0.005
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Market to Book	0.017	0.017	0.017	0.017	0.011
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Leverage	−0.030	−0.030	−0.030	−0.030	−0.029
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Return on Assets	0.085***	0.085***	0.084***	0.085***	0.081***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
Return on Equity	−0.018	−0.018	−0.018	−0.018	−0.016
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Stock Return	0.002	0.002	0.002	0.002	0.007
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Detrended Turnover	0.030	0.030	0.030	0.030	0.022
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Zscore	0.112***	0.112***	0.112***	0.112***	0.100***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)
Ncskew	0.014	0.014	0.014	0.014	0.020
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
CEO Depart 3Y Before	0.116	0.116	0.116	0.116	0.124
	(0.08)	(0.08)	(0.08)	(0.08)	(0.07)
CEO Depart 2Y Before	0.252***	0.252***	0.252***	0.252***	0.253***
	(0.08)	(0.08)	(0.08)	(0.08)	(0.07)
CEO Depart 1Y Before	0.391***	0.391***	0.391***	0.391***	0.354***
	(0.07)	(0.06)	(0.06)	(0.06)	(0.07)

Continued on the next page

CEO Depart	0.177**	0.177**	0.177**	0.177**	0.164**
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
CEO Depart 1Y After	0.026	0.026	0.026	0.026	0.005
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Fixed effects	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry
Observations	12,217	12,217	12,217	12,217	13,875
Pseudo Log-Likelihood	−6692.140	−6692.129	−6692.153	−6692.129	−7541.907
Pseudo R-squared	0.032	0.032	0.032	0.032	0.030

Table 5. Testing for the causal relation using large tariff cuts

This table presents logistic regression estimates examining the relation between R&D managerial narrative disclosure and future stock price crashes in a difference-in-differences setting. The dependent variable is *CRASH*, constituting a dichotomous measure of stock price crashes in fiscal year $t+1$. The variable *Narrative FLS−MD&A* measures the percentage of sentences containing forward-looking R&D-related keywords sourced from the Management's Discussion and Analysis section of the 10-K filing. The binary variable *After* is set equal to one for firms in an industry that has experienced a tariff cut over the last 3 years in models (1) and (2), over the last 4 years in models (3) and (4) and over the last 5 years in models (5) and (6). All explanatory variables are measured in fiscal year t. For variable definitions and details of their calculation, see Appendix A. The estimates include a constant and different fixed effects (as indicated at the bottom of the table) whose coefficients are suppressed. All models include firm fixed effects to control for unobserved time-invariant firm characteristics. All continuous variables are winsorized at the 1st and 99th percentile and are standardized to have a mean value of zero and variance of one. Robust standard errors clustered at the firm level are shown in parentheses. The symbols ***, **, and * denote two-tailed statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
After (3-year)	0.062	0.058				
	(0.08)	(0.08)				
After*Narrative FLS-MD&A (3-year)	0.189***	0.189***				
	(0.06)	(0.06)				
After (4-year)			0.081	0.077		
			(0.08)	(0.09)		
After*Narrative FLS-MD&A (4-year)			0.142**	0.142**		
			(0.06)	(0.06)		
After (5-year)					0.098	0.096
					(0.09)	(0.09)
After*Narrative FLS-MD&A (5-year)					0.108*	0.108*
					(0.06)	(0.06)
Sentiment-MD&A		0.000		−0.011		0.006
		(0.05)		(0.05)		(0.05)
ln(Total Assets)	0.671***	0.644***	0.723***	0.694***	0.703***	0.675***

Continued on the next page

	(0.13)	(0.13)	(0.13)	(0.13)	(0.14)	(0.14)
ln(Firm Age)	−1.578	−1.734	−1.571	−1.738	−1.657	−1.800
	(3.27)	(3.26)	(3.30)	(3.29)	(3.31)	(3.30)
Market to Book	0.029	0.031	0.029	0.031	0.034	0.036
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Leverage	−0.062	−0.057	−0.070	−0.065	−0.059	−0.054
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Return on Assets	0.070*	0.076*	0.052	0.059	0.059	0.065
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Return on Equity	0.019	0.022	0.016	0.018	0.010	0.012
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Stock Return	0.047	0.049	0.042	0.045	0.028	0.029
	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Detrended Turnover	0.047*	0.045*	0.043	0.041	0.050*	0.048*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Zscore	0.290*	0.280*	0.311**	0.299**	0.335**	0.323**
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
Ncskew	−0.129***	−0.130***	−0.134***	−0.136***	−0.140***	−0.142***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
CEO Depart 3Y Before		0.160		0.165		0.139
		(0.11)		(0.11)		(0.12)
CEO Depart 2Y Before		0.010		0.028		−0.008
		(0.11)		(0.11)		(0.12)
CEO Depart 1Y Before		0.283***		0.304***		0.294***
		(0.11)		(0.11)		(0.11)
CEO Depart		0.216**		0.211**		0.202*
		(0.10)		(0.10)		(0.11)

Continued on the next page

CEO Depart 1Y After		−0.061		−0.055		−0.074
		(0.10)		(0.11)		(0.11)
Fixed effects	Year, firm	Year, firm	Year, firm	Year, firm	Year, firm	Year, firm
Observations	8,242	8,242	8,098	8,098	7,932	7,932
Pseudo Likelihood	−4333.591	−4326.931	−4250.887	−4244.038	−4166.332	−4159.650
Pseudo R-squared	0.101	0.103	0.103	0.104	0.101	0.103

Table 6. The effect of R&D managerial narrative disclosure on future stock price crashes: Controlling for innovation activity

This table presents logistic regression estimates examining the relation between R&D managerial narrative disclosure and future stock price crashes. The dependent variable is *CRASH*, constituting a dichotomous measure of stock price crashes in fiscal year $t+1$. The main explanatory variable is *Narrative FLS−MD&A*, which measures the percentage of sentences containing forward-looking R&D-related keywords sourced from the Management's Discussion and Analysis section of the 10-K filing. The baseline regression model is augmented with variables that serve as proxies for innovation activity. Specifically, model (1) includes *R&D Sale*, which is the research and development expense divided by total sales, model (2) includes *R&D Asset*, which is the research and development expense divided by total assets, model (3) includes *Patents Cites*, which is the number of firm's patents granted weighted with their citations, model (4) includes *Innovation Efficiency (R&D-Capital)*, which is the number of patents granted scaled by R&D capital, model (5) includes *Innovation Efficiency (Cites-R&D-Capital)*, which is the number of patents granted weighted with their citations scaled by R&D capital, models (6) and (7) include *Exploitative* and *Explorative* which is the percentage of exploitative/exploratory patents relatively to the number of all patents filed by the firm in the same year, respectively, and model (8) includes *Overconfidence* which is a binary variable set equal to one if the CEO is classified as overconfident based on their tendency to hold options deep in the money (greater than 100%), otherwise 0. All explanatory variables are measured in fiscal year t. For variable definitions and details of their calculation, see Appendix A. The estimates include a constant and different fixed effects (as indicated at the bottom of the table) whose coefficients are suppressed. Industry fixed effects are defined based on the Fama–French 48-industry classification. All continuous variables are winsorized at the 1st and 99th percentile and are standardized to have a mean value of zero and variance of one. Robust standard errors clustered at the firm level are shown in parentheses. The symbols ***, **, and * denote two-tailed statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Narrative FLS-MD&A	0.076***	0.074***	0.081***	0.081***	0.081***	0.080***	0.080***	0.090***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
R&D Sale	0.011							
	(0.01)							
R&D Asset		0.013						
		(0.02)						
ln(Patents Cites)			−0.002					
			(0.02)					
Innovation Efficiency (R&D Capital)				−0.012				

Continued on the next page

				(0.01)				
Innovation Efficiency (Cites-R&D Capital)					0.006			
					(0.01)			
Exploitative						0.055		
						(0.07)		
Explorative							0.112	
							(0.08)	
Overconfidence								0.001
								(0.05)
Sentiment-MD&A	−0.007	−0.009	−0.008	−0.007	−0.008	−0.008	−0.008	0.000
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
ln(Total Assets)	−0.038	−0.038	−0.040	−0.040	−0.040	−0.042	−0.041	−0.047
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
ln(Firm Age)	0.000	0.001	0.001	0.001	0.001	0.000	0.000	0.004
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Market to Book	0.000	−0.001	0.000	0.000	0.000	0.000	0.000	−0.015
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Leverage	−0.010	−0.012	−0.012	−0.013	−0.012	−0.011	−0.012	0.011
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Return on Assets	0.104***	0.102***	0.098***	0.098***	0.098***	0.098***	0.097***	0.108***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Return on Equity	−0.009	−0.008	−0.008	−0.008	−0.008	−0.008	−0.008	−0.011
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Stock Return	0.023	0.024	0.024	0.024	0.025	0.025	0.025	0.035
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Detrended Turnover	0.027	0.026	0.026	0.026	0.026	0.026	0.026	0.020
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Zscore	0.069**	0.067**	0.067**	0.067**	0.067**	0.067**	0.068**	0.070*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)

Continued on the next page

Ncskew	0.021	0.021	0.021	0.021	0.021	0.020	0.020	0.021
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
CEO Depart 3Y Before	0.177**	0.175**	0.174**	0.174**	0.174**	0.175**	0.174**	0.162**
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)
CEO Depart 2Y Before	0.264***	0.262***	0.261***	0.261***	0.261***	0.262***	0.261***	0.210***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)
CEO Depart 1Y Before	0.334***	0.331***	0.331***	0.331***	0.331***	0.332***	0.331***	0.285***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)
CEO Depart	0.164***	0.162***	0.161***	0.161***	0.162***	0.161***	0.162***	0.164**
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
CEO Depart 1Y After	0.024	0.022	0.022	0.021	0.022	0.022	0.022	0.019
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.08)
Fixed effects	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry
Observations	16,735	16,752	16,752	16,752	16,752	16,752	16,752	13,229
Pseudo Log-Likelihood	−9124.136	−9140.204	−9140.373	−9140.204	−9140.308	−9140.045	−9139.441	−7270.179
Pseudo R-squared	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.029

Table 7. The effect of R&D managerial narrative disclosure on future stock price crashes: Controlling for the hoarding of bad news mechanism

This table presents logistic regression estimates examining the relation between R&D managerial narrative disclosure and future stock price crashes. The dependent variable is *CRASH*, a dichotomous measure of stock price crashes in fiscal year $t+1$. The main explanatory variable is *Narrative FLS−MD&A*, which measures the percentage of sentences containing forward-looking R&D-related keywords sourced from the Management's Discussion and Analysis section of the 10-K filing. The baseline regression model is augmented with variables related to the hoarding of bad news mechanism. All explanatory variables are measured in fiscal year t. For variable definitions and details of their calculation, see Appendix A. The estimates include a constant and fixed effects (as indicated at the bottom of the table). Industry fixed effects are defined based on the Fama–French 48-industry classification. All continuous variables are winsorized at the 1st and 99th percentiles and are standardized to have a mean value of zero and variance of one. Robust standard errors clustered at the firm level are shown in parentheses. The symbols ***, **, and * denote two-tailed statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
Narrative FLS-MD&A	0.082***	0.086***	0.093***
	(0.03)	(0.03)	(0.03)
Opacity	−0.049**		
	(0.02)		
Overinvestment		0.020	
		(0.02)	
Option Incentives			−0.005
			(0.02)
Stock Incentives			−0.031
			(0.03)
Depreciation	0.014	0.014*	0.017**
	(0.03)	(0.01)	(0.01)
R&D Cut	−0.055	−0.090	−0.081
	(0.05)	(0.06)	(0.06)
Sentiment-MD&A	−0.019	−0.019	0.018
	(0.02)	(0.02)	(0.02)
Size	−0.045*	−0.034	−0.033
	(0.03)	(0.03)	(0.03)
Firm Age	0.005	−0.006	−0.002
	(0.02)	(0.03)	(0.03)
Market to Book	0.009	0.008	−0.004

Continued on the next page

	(0.02)	(0.02)	(0.02)
Leverage	−0.015	−0.008	0.002
	(0.02)	(0.02)	(0.02)
Return on Assets	0.104***	0.107***	0.098***
	(0.02)	(0.03)	(0.03)
Return on Equity	−0.009	−0.010	−0.013
	(0.02)	(0.02)	(0.02)
Stock Return	0.024	0.033	0.027
	(0.02)	(0.02)	(0.02)
Dturn	0.023	0.021	0.031
	(0.02)	(0.02)	(0.02)
Zscore	0.071**	0.085**	0.064
	(0.03)	(0.04)	(0.04)
Ncskew	0.018	0.029	0.021
	(0.02)	(0.02)	(0.02)
CEO Depart 3Y Before	0.182**	0.170**	0.158**
	(0.07)	(0.08)	(0.08)
CEO Depart 2Y Before	0.286***	0.257***	0.259***
	(0.07)	(0.07)	(0.07)
CEO Depart 1Y Before	0.324***	0.325***	0.351***
	(0.06)	(0.06)	(0.07)
CEO Depart	0.188***	0.165***	0.219***
	(0.06)	(0.06)	(0.07)
CEO Depart 1Y After	0.024	0.023	−0.011
	(0.06)	(0.07)	(0.07)
Fixed effects	Year, industry	Year, industry	Year, industry
Observations	15,999	15,019	13,388
Pseudo Log-Likelihood	−8,707.792	−8,172.784	−7,312.619
Pseudo R-squared	0.029	0.030	0.028

Table 8. The effect of R&D managerial narrative disclosure on future stock price crashes: The role of external corporate governance

This table presents logistic regression estimates examining the relation between R&D managerial narrative disclosure and future stock price crashes, considering the role of external governance. The dependent variable is *CRASH*, constituting a dichotomous measure of stock price crashes in fiscal year $t+1$. The main explanatory variable is *Narrative FLS−MD&A*, which measures the percentage of sentences containing forward-looking R&D-related keywords sourced from the Management's Discussion and Analysis section of the 10-K filing. The baseline regression model is estimated in subsamples based on a firm's competitive environment (*Competitiveness*), managerial entrenchment (*Entrenchment*) and investors' attention (*Number of Analysts*). The High/Low *Competitiveness* subsamples comprise observations as defined by the above/below median of the *Competitiveness*. The High/Low *Entrenchment* subsamples comprise observations where the manager does not hold any other titles and holds at least one extra title. The *Number of Analysts* subsamples comprise observations where the number of analysts is either at least one (≥ 1) or zero ($= 0$). All explanatory variables are measured in fiscal year t. For variable definitions and details of their calculation, see Appendix A. The estimates include a constant and different fixed effects (as indicated at the bottom of the table) whose coefficients are suppressed. Industry fixed effects are defined based on the Fama–French 48-industry classification. All continuous variables are winsorized at the 1st and 99th percentile and are standardized to have a mean value of zero and variance of one. Robust standard errors clustered at the firm level are shown in parentheses. The symbols ***, **, and * denote two-tailed statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Competitiveness		Entrenchment		Number of Analysts	
	Low	High	Low	High	≥ 1	$= 0$
Narrative FLS-MD&A	0.052	0.108***	0.110***	0.051	0.071***	0.225
	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.15)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry
Observations	8,333	8,401	6,631	10,114	16,233	460
Pseudo Log-Likelihood	−4535.647	−4557.650	−3592.850	−5495.729	−8887.735	−203.985
Pseudo R-squared	0.028	0.037	0.043	0.027	0.028	0.139

Table 9. The effect of R&D managerial narrative disclosure on future stock price crashes: The role of internal corporate governance

This table presents logistic regression estimates examining the relation between R&D managerial narrative disclosure and future stock price crashes, considering the role of internal governance. The dependent variable is *CRASH*, constituting a dichotomous measure of stock price crashes in fiscal year $t+1$. The main explanatory variable is *Narrative FLS−MD&A*, which measures the percentage of sentences containing forward-looking R&D-related keywords sourced from the Management's Discussion and Analysis section of the 10-K filing. The baseline regression model is estimated in subsamples based on board size, number of independent directors, female on board, busy directors and directors that do not attend meetings. The High/Low *Board Size* subsamples comprise observations as defined by the above/below median number of board members. The *Percentage of Independent Directors* subsamples comprises observations where the independent directors on a board have the majority ($> 50\%$) or minority($\leq 50\%$). The *Number of Female Directors* subsamples comprise observations where the number of female directors is either at least one (≥ 1) or zero ($= 0$). The *Number of Busy Directors* subsamples comprise observations where the number of busy directors is either at least one (≥ 1) or zero ($= 0$). The *Number of Not Attended Directors* subsamples comprise observations where the number of directors who did not attend is either at least one (≥ 1) or zero ($= 0$). All explanatory variables are measured in fiscal year t. For variable definitions and details of their calculation, see Appendix A. The estimates include a constant and different fixed effects (as indicated at the bottom of the table) whose coefficients are suppressed. Industry fixed effects are defined based on the Fama–French 48-industry classification. All continuous variables are winsorized at the 1st and 99th percentile and are standardized to have a mean value of zero and variance of one. Robust standard errors clustered at the firm level are shown in parentheses. The symbols ***, **, and * denote two-tailed statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Board size		Percentage of independent directors		Number of female directors		Number of busy directors		Number of not attended directors	
	High	Low	$> 50\%$	$\leq 50\%$	> 1	≤ 1	≥ 1	$= 0$	≥ 1	$= 0$
Narrative FLS-MD&A	0.060**	0.149***	0.058*	0.112***	0.074***	0.124**	0.087**	0.076**	0.102***	0.066**
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.06)	(0.04)	(0.03)	(0.04)	(0.03)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry
Observations	12,001	4,739	10,209	6,534	13,781	2,969	7,074	9,672	6,571	10,146
Pseudo Log-Likelihood	−6472.523	−2612.748	−5587.036	−3490.834	−7495.645	−1610.615	−3788.760	−5297.195	−3526.188	−5556.263
Pseudo R-squared	0.026	0.049	0.036	0.032	0.028	0.048	0.030	0.036	0.030	0.035

Table 10. The effect of cheap talk on future patent outputs

This table presents regression estimates examining the relation between cheap talk with future patent outputs. The dependent variables are *Cumulative Patents* (Models 1-3), *Weighted Average of Cumulative Patents* (Models 4-6), *Cumulative Value of Patents* (Models 7-9), *Weighted Average of Cumulative Value of Patents* (Models 10-12), measured in fiscal years $t+1$, $t+2$ and $t+3$. The explanatory variables are *Positive Change in Narrative FLS−MD&A*, *Positive Change in R&D*, *Crash*, and the interaction terms between *Crash* and the change variables, which are denoted as *Cheap Talk* and *Crash with Positive Change in R&D*, respectively. Both positive change variables are measured as the difference between the fiscal year $t-1$ and fiscal year t. Crash is measured in fiscal year t. For variable definitions and details of their calculation, see Appendix A. The estimates include a constant and different fixed effects (as indicated at the bottom of the table) whose coefficients are suppressed. Industry fixed effects are defined based on the Fama–French 48-industry classification. All continuous variables are standardized to have a mean value of zero and variance of one. Robust standard errors clustered at the firm level are shown in parentheses. The symbols ***, **, and * denote two-tailed statistical significance at the 1%, 5%, and 10% level, respectively.

	Cumulative Patents			Weighted Average of Cumulative Patents			Cumulative Value of Patents			Weighted Average of Cumulative Value of Patents		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Cheap Talk	-0.162**		-0.170**	-0.054**		-0.056**	-0.188*		-0.166*	-0.064*		-0.057*
	(0.08)		(0.08)	(0.03)		(0.03)	(0.11)		(0.10)	(0.03)		(0.03)
Positive Change in Narrative FLS-MD&A	0.182**		0.165**	0.061**		0.056**	0.073		0.071	0.027		0.026
	(0.09)		(0.08)	(0.03)		(0.03)	(0.06)		(0.06)	(0.02)		(0.02)
Crash with Positive Change in R&D		-0.055	-0.001		-0.018	-0.000		-0.140	-0.102		-0.045	-0.032
		(0.07)	(0.08)		(0.02)	(0.03)		(0.09)	(0.09)		(0.03)	(0.03)
Positive Change in R&D		0.223***	0.213***		0.075***	0.072***		0.008	-0.008		0.002	-0.004
		(0.08)	(0.08)		(0.03)	(0.03)		(0.05)	(0.04)		(0.02)	(0.02)
Crash	-0.032	-0.063	-0.035	-0.011	-0.021	-0.012	-0.020	-0.037	0.006	-0.009	-0.015	-0.000
	(0.04)	(0.04)	(0.03)	(0.01)	(0.01)	(0.01)	(0.08)	(0.08)	(0.10)	(0.03)	(0.03)	(0.03)
Leverage	-0.143**	-0.149***	-0.140**	-0.048**	-0.050***	-0.047**	0.036	0.025	0.036	0.012	0.008	0.012
	(0.06)	(0.06)	(0.06)	(0.02)	(0.02)	(0.02)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)
Market to book	0.115**	0.110**	0.115**	0.039**	0.037**	0.039**	0.376***	0.374***	0.376***	0.128***	0.128***	0.128***
	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.11)	(0.11)	(0.11)	(0.04)	(0.04)	(0.04)
Size	0.624***	0.653***	0.620***	0.209***	0.219***	0.208***	-0.447***	-0.428***	-0.446***	-0.149***	-0.142***	-0.148***
	(0.17)	(0.16)	(0.17)	(0.06)	(0.05)	(0.06)	(0.07)	(0.06)	(0.07)	(0.02)	(0.02)	(0.02)
Return on Equity	-0.004	-0.003	-0.002	-0.001	-0.001	-0.001	-0.170**	-0.161**	-0.170**	-0.059**	-0.056***	-0.060**
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.07)	(0.06)	(0.07)	(0.02)	(0.02)	(0.02)
Firm Age	0.067	0.049	0.067	0.023	0.017	0.023	-0.043*	-0.048**	-0.043*	-0.014*	-0.016**	-0.014*
	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.01)	(0.01)	(0.01)
Return on Assets	-0.022	-0.019	-0.022	-0.007	-0.006	-0.007	0.094	0.095	0.094	0.032	0.032	0.032
	(0.03)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	(0.09)	(0.08)	(0.09)	(0.03)	(0.03)	(0.03)
Fixed effects	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year, industry	Year industry
Observations	15660	16728	15660	15660	16728	15660	13338	14292	13338	13338	14292	13338
R-squared	0.125	0.122	0.127	0.126	0.123	0.129	0.114	0.114	0.114	0.117	0.117	0.117