Independence versus expertise: A quantitative study on the effect of board independence on annual report readability

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ABSTRACT
I analyze the effect of board independence on the readability of a firm's management discussion and analysis (MD&A) section of the annual report. Using the Fog index as my primary measure of readability, I find no clear effect of board independence on the readability of the MD&A section. Additional analyses provide some indications of a negative relation between board independence and readability. More independent boards have considerably lengthier MD&A sections. This effect is both statistically and economically significant. Taken together, my findings cast some doubt on the management obfuscation theory and show that when it comes to readability, expertise is preferred over independence.

Keywords: annual report readability; board independence; Fog index; management obfuscation theory; agency theory

1. Introduction

The consequences of financial disclosure readability are widely documented in the accounting literature of the last decade. Less readable disclosures result in less accurate analyst forecasts (Lehavy, Li & Merkley, 2011), weaker reactions from small investors (Rennekamp, 2012), and higher costs of debt (Bonsall & Miller, 2017) and equity (Rjiba, Saadi, Boubaker & Ding, 2021). A question that has gotten much less attention is what determines financial disclosure readability. Li (2008) and Lo, Ramos, and Rogo (2017) analyze the effect of earnings and earnings management, respectively, on the readability of (sections of) the annual report. I propose a different avenue of research into determinants of financial disclosure readability, namely that of corporate governance. More specifically, I analyze the effect of board independence on the management discussion and analysis (MD&A) section of a firm's 10-K filing. The MD&A contains managements' explanation of the company's financial statements and outlines managements' outlook on current and future performance (SEC, 2020). I consider it the ideal section to hide or obfuscate information because of the freedom allowed in writing it and the importance investors place on the section.

Following Muth and Donaldson (1998), I divide board independence in leadership structure, as measured by CEO duality, and board structure, as measured by the proportion of independent directors minus the proportion of inside directors on the board. Consistent with prior literature, I measure the readability of the MD&A by calculating the Fog index, which measures textual complexity based on the number of complex words and average sentence length. In additional analyses, I employ different measures of readability and a different measure of board structure.

The readability of financial disclosures is determined by both the inherent difficulty of the subject and the obfuscation component. Obfuscation refers to the intentional decrease in readability by management to increase information processing costs (Li, 2008). Following agency theory, an independent board is better able to control this opportunistic behavior by management. Therefore, I hypothesize that board independence has a positive effect on the readability of the MD&A. Furthermore, I predict this effect to be stronger when firms report bad news because management has both incentives to decrease readability when their firm reports bad news and increase readability when their firm reports good news. To extract the obfuscation component of readability, I use a measure proposed by Rjiba et al. (2021). I predict that board independence has a negative effect on MD&A obfuscation.

Using an ordinary least squares model, I test the hypothesized relation between board independence and readability. My findings are inconsistent with the predicted relation. Using a sample of 6,395 firm-years of S&P 1500 firms from 2007-2019, I find a negative but insignificant effect of board independence on the Fog of the MD&A. Additional tests using the Flesch reading ease score and the Flesch-Kincaid readability score provide similar results. When the length of the MD&A is considered as a measure of readability, however, the negative effect of board independence becomes both statistically and economically significant. Independent boards have lengthier MD&A's which are seen as more complex and less transparent (Li, 2008). A possible explanation for this finding may be that insider-dominated boards have superior knowledge and expertise compared to independent boards, which allows them to disclose information in a more understandable manner. This explanation could still be consistent with independent boards being more effective in preventing management obfuscation, thus increasing readability. However, this effect would then be counteracted by insider-dominated boards having superior knowledge and expertise. These simultaneous counteracting effects may explain the insignificance of the results found using the Fog index.

However, the negative effect of board independence on readability also holds when I consider only the obfuscation component of readability, where readability is measured as the length of the MD&A. Inconsistent with the predicted relation, independent boards seem to obfuscate more by providing lengthier MD&A’s, thus casting doubt on management obfuscation theory as well as the alternative explanation of counteracting effects as outlined above. When I consider the combined effect of bad news and board independence on readability, I find some indication of a negative relation. However, the results are largely insignificant. Taken together, my findings indicate no positive effect of board independence on readability. On The Contrary, they provide some indications of a negative relation. Perhaps when it comes to readability, insider-dominated boards are preferred because of their superior knowledge and expertise, which allows them to increase readability.

This study contributes to the literature on determinants of financial disclosure readability. Previous studies focused mainly on earnings and earnings properties as determinants. However, Li (2008) concludes that economic performance is not a first-order determinant of disclosure readability. I, therefore, extend this literature by studying the effect of board independence on readability. Second, this study provides some evidence against management obfuscation theory. This theory states that management may be motivated to increase information processing costs by decreasing readability. Following this theory, one would expect insider-dominated boards to have less readable MD&A’s. My findings, however, provide some indications that insider-dominated boards have more readable MD&A’s, thus casting doubt on management obfuscation theory.

This study also has implications for practice. Because my findings provide some indications of a negative effect of board independence on readability, shareholders and regulators may reconsider their stance on the desirability of independent boards, especially considering the negative consequences of low readability for both investors and firms themselves. When it comes to expressing information in an understandable manner, my findings indicate that expertise may be preferred over independence.

This paper is closely related to Ginesti, Drago, Macchioni, and Sannino (2018), who examine the effect of female board participation on annual report readability. While board independence is not the main interest of Ginesti et al. (2018), they employ both CEO duality and the proportion of independent directors as controls. My paper differs from Ginesti et al. (2018) in that I focus on the readability of the MD&A, whereas Ginesti et al. analyze the 10-K filing as a whole. Furthermore, Ginesti et al. employ a small hand-collected sample of 435 Italian firm-years, whereas my sample consists of 6,395 firm-years of S&P 1500 firms. Lastly, Ginesti et al. employ a set of financial control variables that is limited to earnings, size, and financial leverage. Several financial determinants of readability, as identified by Li (2008), are not included in the analyses. Ginesti et al. do, however, make a distinction between the number of boardroom connections, whereas I do not make such a distinction. Overall my paper differs from Ginesti et al. (2018) in research question, control variables employed, sample size, and the type of disclosure analyzed.

The rest of this paper is organized as follows. Section **2** provides theoretical background on financial disclosure readability and develops the hypotheses. Section **3** discusses the data and methodology. Section **4** presents the results. Section **5** presents the robustness tests. Section **6** concludes.

2. Theoretical background and hypotheses development

2.1. Background

Readability refers to the ease with which a text can be processed and comprehended (Bonsall, Leone, Miller & Rennekamp, 2017). Less readable disclosures are more difficult to understand (Lehavy et al., 2011). They require investors to exert more time and effort to comprehend and extract relevant information. The readability of financial disclosures can therefore be seen as a measure of information processing costs. Processing less readable disclosures takes more time and effort, which means higher costs, whereas processing more readable disclosures is less costly.

Consistent with this, Lehavy et al. (2011) find that less readable 10-K filings are associated with increased analyst following. Because the information processing costs increase, the demand for analyst services increases as well. Simultaneously, the effort exerted by analysts to generate their reports increases for less readable filings. Still, earnings forecasts are less accurate and more dispersed for firms with less readable 10-K filings. These findings indicate that even analysts, who are arguably well-trained in reading complex annual reports, have trouble deciphering less readable reports.

Besides analysts, also investors are affected by the readability of financial disclosures. You and Zhang (2009) find that investors tend to have a stronger underreaction to lengthier 10-K filings. Miller (2010) extends this finding and shows that less readable filings are associated with lower trading volumes. The reduction in trade activity is primarily driven by small investors, who, due to higher information processing costs, may choose not to read the filing and consequently do not initiate trades following its publication. This finding is supported by Lawrence (2013), who shows that individual investors are more likely to invest in firms with more readable disclosures. Rennekamp (2012) examines the effect of readability on small investors in an experimental research setting and finds that more readable disclosures result in a stronger reaction from small investors. Readable bad (good) news results in a lower (higher) valuation than unreadable bad (good) news. This effect is even more pronounced when performance benchmarks are inconsistent (Tan, Wang & Zhou, 2015). Overall, research shows that disclosure readability affects mainly small and individual investors.

Disclosure readability, however, also has consequences for the firm itself. Firms with less readable 10-K filings have lower bond ratings and higher costs of debt capital, as measured by the credit spread on bonds (Bonsall & Miller, 2017). Ertugrul, Lei, Qiu, and Wan (2017) find evidence that suggests low readability also leads to higher costs of bank debt. Similar results are found for costs of equity capital, which are higher for firms with less readable 10-K filings. (Garel, Gilber & Scott, 2019; Rjiba et al., 2021). These findings show that not only investors can benefit from increased readability, but firms themselves as well since they can attract external financing more easily.

Research on financial disclosure readability generally differentiates between two components that determine readability. On the one hand, readability can decrease due to the inherent difficulty of the subject. Bushee, Gow, and Taylor (2018) refer to this as the information component, while Bloomfield (2008) refers to this as ontology. The second component that determines readability is the obfuscation component. This component refers to the intentional decrease in readability by management to increase information processing costs (Li, 2008). Li theorizes that management may want to increase information processing costs to delay or reduce market reactions to bad news. While his findings support this management obfuscation hypothesis, he cannot fully mitigate the concern that bad news is inherently more difficult to report.

Most research into the readability of a firm's financial disclosures focuses on 10-K filings or sections of it. Following Lo et al. (2017), I analyze the readability of the management discussion and analysis (MD&A) section rather than the 10-K filing as a whole. A 10-K filing consists of different sections that vary in importance. Furthermore, several sections may consist of more legalese and boilerplate language, thus decreasing readability. To prevent the possibility of less important sections driving the results, I opt to focus on just one section in particular, namely the MD&A section. The MD&A contains managements' explanation of the company's financial statements and outlines managements' outlook on current and future performance (SEC, 2020). The section should not consist of standardized disclosures but instead gives management the discretion to tailor the disclosure to specific circumstances. Furthermore, the MD&A section is crucial to understanding a firm's performance (Lo et al., 2017). Feldman, Govindaraj, Livnat, and Segal (2010) show that the tone used in the MD&A is value-relevant, further highlighting the importance of the MD&A section.

Schroeder and Gibson (1990) are one of the first to examine the readability of the MD&A. They analyze a small sample of firms and find that the MD&A is less readable than the President's letter and more comparable to the notes in terms of readability. More recent studies by Li (2008) and Lo et al. (2017) examine the readability of the MD&A on a much larger scale. Li finds that the MD&A is, on average, much more readable than the 10-K filing as a whole, which may be an indication of less legalese and boilerplate language within the MD&A. When the readability of the MD&A decreases, this can be either due to the inherent difficulty of the subject or due to management obfuscation. Given the importance of the section and the discretion allowed in writing it, the MD&A is considered ideal for obfuscating information. A decrease in readability will increase information processing costs, which adversely affects analysts, investors, and the firm itself.

2.2. Board independence and MD&A readability

One mechanism that governs the quality of a firm's reporting is the board of directors. The board of directors is, from an agency perspective, tasked to represent shareholder interest and protect against opportunistic managerial behavior (Muth & Donaldson, 1998). From this perspective, a board of directors independent of management is preferred since it is better able to control management's behavior. From a stewardship perspective, however, management is intrinsically motivated to behave as good stewards and act in the firm's best interest. Therefore, a board of directors dominated by insiders is preferred because of their superior knowledge and expertise. According to Muth and Donaldson (1998), board independence consists of two different components. On the one hand, board structure, and on the other hand, leadership structure. Board structure refers to the independence of individual directors. Leadership structure refers to the separation of the role of CEO and that of chairman of the board. The combination of both roles is also known as CEO duality. From an agency (stewardship) perspective, more (less) independent directors are preferred, and CEO duality should be prevented (supported).

When it comes to boards exercising effective governance, empirical evidence supports agency theory. Weisbach (1988) finds that independent boards are more likely to remove a CEO based on performance, indicating that independent boards are more objective. Furthermore, studies by Byrd and Hickman (1992) and Brickley, Coles, and Terry (1994) suggest that independent boards better represent shareholder interest in the case of (potential) takeovers. The former, however, note that there is also such a thing as too much independence.

Secondly, an independent board increases a firm's financial reporting quality. Beasley (1996) finds that firms with more independent directors are less likely to experience financial statement fraud. Furthermore, they are less likely to overstate earnings, as evidenced by SEC enforcement actions (Dechow, Sloan & Sweeney, 1996), or manage earnings in general, as evidenced by abnormal accruals (Klein, 2002). Lastly, firms with more independent directors have higher audit fees, which may indicate that independent boards purchase higher quality audit services (Carcello, Hermanson, Neal & Riley, 2002). These findings are consistent with agency theory and indicate that independent boards are preferred when it comes to financial reporting quality.

Literature on readability has also adopted an agency approach. Management obfuscation theory states that management may be motivated to increase information processing costs by decreasing readability. This opportunistic behavior by management is not in the best interest of shareholders but rather may be the result of capital market motivations. Since an independent board is able to provide oversight more freely and evaluate management more critically, it may step in sooner when it realizes management is intentionally obfuscating information. Secondly, an independent board may also be more critical of low readability in general, irrespective of the intention behind it, thus leading to an increase in readability. This agency approach is consistent with empirical evidence on both effective governance and financial reporting quality. Since readability or, more generally, disclosure quality is closely related to financial reporting quality, such an approach seems empirically warranted.

On the other hand, a board dominated by insiders may have superior knowledge and skill compared to an independent board. As a result, they may be better at bringing across their message without using difficult language, therefore increasing readability. However, Li (2008) provides some additional evidence on management obfuscation theory. Firms with more unexercised executive stock options are more likely to decrease readability when current positive earnings are not persistent. This finding shows that management does indeed behave opportunistically and does need to be controlled by the board. An independent board would be better equipped to protect investors against this behavior.

Thus, based on the discussion above, the first hypothesis is:

H1. Board independence has a positive effect on the readability of the MD&A.

2.3. The role of bad news

When an annual report contains bad news, management has incentives to decrease readability. Rennekamp (2012) shows that less readable disclosures result in a weaker reaction from investors. Thus, if management wants to weaken the impact of bad news on the stock market, it could obfuscate its disclosures. Li (2008) finds that annual reports of firms that report losses are on average less readable, which is consistent with this obfuscation hypothesis. When a firm reports good news, however, management has incentives to increase readability to increase the stock market reaction to good news. Still, the alternative explanation, that bad (good) news is inherently more difficult (easier) to report, cannot be fully refuted.

When management wants to obfuscate bad news, it is expected that an independent board is better at preventing this. Therefore, the effect of an independent board is stronger when firms report bad news. If, on the other hand, an annual report contains good news, management is incentivized to increase readability. Given the alignment of interest between investors and management, the positive effect of an independent board is expected to be lower for good news firms and thus higher for bad news firms. If the positive effect of an independent board on readability is indeed stronger for firms reporting bad news, this provides additional evidence in support of the management obfuscation hypothesis.

Therefore, based on the discussion above, the second hypothesis is:

H2. Board independence has a stronger positive effect on the readability of the MD&A when a firm reports bad news.

2.4. Board independence and MD&A obfuscation

Since readability is determined by both the inherent difficulty of the subject and the obfuscation component, low readability is not necessarily problematic. Firms with a more complex business model may, by definition, have a more complex MD&A. While I do implement controls to capture firm complexity, such controls are by no means perfect. Therefore, using a measure recently proposed by Rjiba et al. (2021), I attempt to isolate the obfuscation component of readability. I regress readability on several variables capturing firm complexity and calculate the expected readability scores in the absence of obfuscation incentives. The unexplained or abnormal portion of readability is then assumed to capture the obfuscation component of readability. Following similar reasoning as before, I expect obfuscation to decrease when board independence increases.

Thus, the third hypothesis is:

H3. Board independence has a negative effect on MD&A obfuscation.

3. Data and methodology

3.1. Data and sample

I begin my sample selection with US Compustat firms for the years 2007-2019. I require observations to have sufficient data to calculate discretionary accruals following the cross-sectional Jones (1991) model with at least ten observations per two-digit standard industry code (SIC) per year. I remove firms in the financial services industries (SIC 6000-6999) because of differences in the interpretation of their financials. I then require observations to have sufficient financial, security, and segment data available in Compustat. To control for firm-years with merger and acquisition (M&A) activity, I match Zephyr data by ticker and year to Compustat. Next, I use ExecuComp to identify CEO duality and Institutional Shareholder Services (ISS) to identify the independence of individual directors on the board. ExecuComp covers executive

Table 1
Sample selection.

	Firm-years	Unique firms
All Compustat firm-years 2007-2019	134,515	16,629
Less: Observations with insufficient data to run Jones model	-53,751	-4,736
Less: Observations in financial service industry	-14,703	-2,105
Less: Observations with missing financial data	-35,819	-5,417
Less: Observations with missing board independence data	-21,046	-3,074
Less: Observations with missing readability data	-2,801	-88
Full sample (H1 & H2)	**6,395**	**1,209**
Less: Observations with missing abnormal readability data	-201	-20
Abnormal readability sample (H3)	**6,194**	**1,189**

This table reports the sample selection procedure for the full sample and the abnormal readability sample.

compensation data for over 2,500 firms which includes current and prior S&P 1500 firms. ISS also covers S&P 1500 firms, which means the final sample consists only of S&P 1500 firms. I match ISS data by Central Index Key (CIK) and year to Compustat. Finally, I use the Edgar package by Lonare, Patil, and Raut (2020) to scrape, extract and parse a firm's MD&A section from the SEC EDGAR database per CIK per year. I then use the Quanteda package by Benoit et al. (2018) to calculate the readability scores of each MD&A. I require at least 200 words per MD&A. Observations with less than 200 words tended to show extreme readability scores. Manual checks confirmed that these files were incorrectly extracted and were therefore excluded. This procedure results in a final sample of 6,395 firm-years and 1,209 unique firms for Hypotheses 1 and 2. To predict abnormal readability, I require additional Compustat variables, which leads to a reduced sample size of 6,194 firm-years and 1,189 unique firms for Hypothesis 3. The sample selection process is outlined in **Table 1**.

For Hypothesis 1 and 2 (Hypothesis 3), the year 2010 contains 73 (72) observations, the year 2015 contains 150 (150) observations, and 2017 contains 175 (170) observations. The other years contain between 434 (2007) and 686 (2013) observations for Hypothesis 1 and 2, and between 417 (2007) and 670 (2013) observations for Hypothesis 3. The underrepresentation of the years 2010, 2015, and 2017 is due to the Edgar package incorrectly failing to identify 10-K filings for a large number of firms in these years. However, since year-fixed effects are included in the regression, this underrepresentation should not be problematic.

3.2. Readability

To measure the readability of the management discussion and analysis section, I employ the Gunning Fog index. This linguistic measure has been used widely throughout the accounting literature (e.g., Lehavy et al., 2011; Li, 2008; Lo et al., 2017; Rennekamp, 2012). It captures textual complexity based on syllables per word and words per sentence and estimates the number of years of formal education a person needs to understand a text. Higher values indicate a less readable text. The Fog index is calculated as follows:

$$Fog = 0.4 * (words\ per\ sentence + percentage\ of\ complex\ words), \quad (1)$$

where complex words are defined as words consisting of three syllables or more. In additional robustness tests, I also employ the Flesch-Kincaid readability score, the Flesch reading ease score, and the length of the MD&A as alternative measures of readability.

For Hypothesis 3, I employ a measure of abnormal readability, which attempts to capture the obfuscation component of readability. I regress readability on several measures capturing firm complexity. The residuals of this regression represent the unexplained or abnormal portion of readability. It is the part of readability that is not explained by firm complexity but instead represents the obfuscation component of readability. Following Rjiba et al. (2021), I calculate abnormal readability by regressing the following equation:

$$\begin{aligned} Readability_{it} = {} & \beta_0 + \beta_1 Acq_{it} + \beta_2 BTM_{it} + \beta_3 CapEx_{it} + \beta_4 CapInt_{it} \\ & + \beta_5 CFVol_{it} + \beta_6 Financing_{it} + \beta_7 GWImp_{it} + \beta_8 Leverage_{it} \\ & + \beta_9 M\&A_{it} + \beta_{10} NBSeg_{it} + \beta_{11} NGSeg_{it} + \beta_{12} R\&D_{it} \\ & + \beta_{13} Restr_{it} + \beta_{14} Return_{it} + \beta_{15} SEO_{it} + \beta_{16} Size_{it} \\ & + \sum \beta_f (Industry, Year) + \varepsilon_{it}, \end{aligned} \tag{2}$$

where $Readability_{it}$ is defined as the FOG index of the MD&A. In additional robustness tests, I again employ the Flesch-Kincaid readability score, the Flesch reading ease score, and the length of the MD&A as alternative measures to calculate abnormal readability. **Table 2** reports the descriptive statistics of the determinants of abnormal readability. All continuous variables are winsorized at the 1st and 99th percentile levels. A full explanation of all variables can be found in **Appendix A**.

3.3. Independent variables

The independent variable of interest is board independence. Board independence consists of two components. On the one hand, leadership structure, and on the other hand, board structure. To measure leadership structure, I create an indicator variable called $CEO\ duality_{it}$ that is equal to 1 when a firm's CEO is also chairman of the board of directors in that year and 0 otherwise. To measure board structure, I follow Bhagat and Black (2001) and calculate $INDEP_{it}$ as the proportion of independent directors minus the proportion of inside directors for each firm-year. This measure distinguishes between independent directors, affiliated directors, and inside directors, and weighs them as +1, 0, and -1, respectively. In additional tests, I also employ the proportion of independent directors as a measure of board structure. This second measure, however, treats affiliated and inside directors as equally non-independent.

For Hypothesis 2, the effect of $Bad\ news_{it}$ is interacted with both board structure and leadership structure to capture the interaction effect of bad news and board independence on readability. I define $Bad\ news_{it}$ as either a loss-making firm-year or as a firm-year with a negative earnings change.

3.4. Control variables

The control variables are derived mainly from the controls employed by Li (2008). Following Li (2008), I include size, market-to-book ratio, firm age, special items, return volatility, earnings volatility, the number of business segments, the number of geographic segments, merger and acquisition (M&A) activity, seasoned equity offering (SEO), and an indicator variable for firms incorporated in Delaware as control variables. Furthermore, I control for loss-making firm-years and firm-years with negative earnings changes because Li (2008) finds that the MD&A is less readable for these firm-years. As opposed to Li (2008), I do not include the number of non-missing Compustat items as a measure of financial complexity. While it may capture financial complexity if all firms are fully covered by Compustat, this may not be the case. Rather than being a measure of financial complexity, the

Table 2
Descriptive statistics of determinants of abnormal readability.

Variable	Mean	SD	25th	Median	75th
Acq	0.030	0.063	0.000	0.001	0.026
BTM	0.513	0.335	0.281	0.437	0.658
CapEx	0.050	0.050	0.018	0.033	0.062
CapInt	0.267	0.243	0.088	0.180	0.364
CFVol	0.039	0.030	0.020	0.031	0.049
Financing	0.115	0.183	0.007	0.037	0.137
GWImp	0.113	0.317	0.000	0.000	0.000
Leverage	0.209	0.165	0.054	0.204	0.323
M&A	0.300	0.458	0.000	0.000	1.000
NBSeg	1.226	0.464	0.693	1.386	1.609
NGSeg	1.364	0.506	1.099	1.386	1.792
R&D	0.051	0.081	0.000	0.010	0.074
Restr	0.454	0.498	0.000	0.000	1.000
Return	1.128	0.399	0.875	1.107	1.336
SEO	0.045	0.207	0.000	0.000	0.000
Size	7.888	1.505	6.826	7.743	8.852
Observations	6,194				

This table reports descriptive statistics of the determinants of abnormal readability. All continuous variables are winsorized at 1% and 99% of the distribution. For detailed variable definitions see **Appendix A**.

number of non-missing Compustat items may simply capture the coverage rate of Compustat for that specific firm. Li (2008) also mentions that the measure is perhaps misspecified.

To control for the effect of earnings management on readability found by Lo et al. (2017), I include the absolute value of discretionary accruals based on the Jones (1991) model to capture accrual-based earnings management, and the absolute value of the change in advertising and R&D expenditures, to capture real earnings management. Whereas Lo et al. (2017) use signed values for discretionary accruals and real earnings management, I use absolute values. I do this because Lo et al. (2017) specifically investigate discretionary accruals and real earnings management in a setting where ex-ante earnings are expected to be managed upwards. Conversely, in my research setting, there is no expected direction for earnings management. I expect firms with higher absolute values for discretionary accruals and real earnings management to have more complex MD&A's.

Next, I include a control variable for firms audited by a Big N audit firm. De Franco, Fogel-Yaari, and Li (2020) find that, although auditors do not audit the MD&A, there are textual similarities between the MD&A's of firms audited by the same auditor. This finding indicates that auditors can influence the text of an MD&A and thus also its readability. Since Big N auditors are generally associated with higher audit quality (e.g., Becker, DeFond, Jiambalvo, & Subramanyam, 1998; DeAngelo, 1981), I expect firms audited by a Big N auditor to have more readable MD&A's. Lastly, I include the variable board size to control for the number of directors on the board.

3.5. Research design

To test my hypotheses, I apply an ordinary least squares (OLS) model with industry- and year-fixed effects. I include year-fixed effects because the complexity of firms' disclosures seems to increase over time. Dyer, Lang, and Stice-Lawrence (2017) argue that this is due to regulatory requirements. I include industry-fixed effects based on two-digit SIC to account for differences in industry complexity. The inclusion of fixed effects results in the following base model for testing the hypotheses:

$$Readability_{it} = \beta_0 + \beta_1 INDEP_{it} + \beta_2 CEO\ duality_{it} + \sum\beta_k Control\ variables_{it} + \sum\beta_f (Industry, Year) + \varepsilon_{it}, \quad (3)$$

where $Readability_{it}$ denotes one of the (abnormal) readability scores discussed in section **3.2**. All standard errors are clustered at the firm-level to control for within-firm correlation of MD&A readability. I expect the sign of β_1 to be negative since more independent directors are expected to decrease the textual complexity of the MD&A. The sign of β_2 is expected to be positive since CEO duality is expected to increase textual complexity. To test if the positive effect of board independence on readability increases when a firm reports bad news (**H2**), I interact $Bad\ news_{it}$ with both $CEO\ duality_{it}$ and $INDEP_{it}$. The coefficient of the first interaction is expected to be positive, while the coefficient of the second interaction is expected to be negative.

For Hypothesis 1 and 2, I employ the complete set of control variables discussed above. However, for the abnormal readability sample in Hypothesis 3, I exclude the control variables already used to calculate abnormal readability, which means size, SEO, M&A, the number of business segments, and the number of geographic segments are not included as controls. In an untabulated test, I employ the full set of control variables. The results are qualitatively similar to the main analysis.

3.6. Descriptive statistics

Table 3 shows the descriptive statistics of both the full sample and the abnormal readability sample. The mean and median value of the Fog is around 21.1, which indicates that the average MD&A is highly unreadable. It is much higher than the average Fog found by Li (2008) and Lo et al. (2017) of around 18. One explanation for this is that the average firm in my sample is around eight times as large as the average firm in the sample of Lo et al. (2017), which may lead to more complex MD&A's.[1] A second possible explanation is that my sample is from a later period than the samples from Li (2008) and Lo et al. (2017). Since Dyer et al. (2017) note a decrease in readability over time, this may explain the higher Fog in my sample. Lastly, I use different software to extract the MD&A and calculate the Fog compared to Li (2008), who uses Perl.[2] While in its most basic form, the Fog is calculated following the same formula, subtle accents may still differ per software program, which may result in a different readability score for the same text.

The proportion of independent directors minus the proportion of inside directors has a mean of 0.641 and a median of 0.700, which shows that boards are on average highly independent. CEO duality, however, has a mean of 0.514, indicating that more than half of the CEOs are also chairman of the board of directors. On average, 15% of the firm-years are loss-making firm-years, and in 43% of the firm-years, firms experience a negative earnings change.

[1] Undoing the log transformation results in a mean firm size of 319.90 for the sample of Lo et al. (2017) and a mean firm size of 2,662.44 for my sample. The mean firm size is not given in Li (2008).
[2] Li (2008) uses the Lingua::EN:Fathom package of the Perl language. It is unclear what software Lo et al. (2017) use to extract the MD&A and calculate the Fog.

Table 3
Descriptive statistics.

	Full sample					Abnormal readability sample				
Variable	Mean	SD	25th	Median	75th	Mean	SD	25th	Median	75th
AbFog						0.000	1.351	-0.871	-0.082	0.819
Age	27.398	15.078	15.000	23.000	42.000	27.509	15.049	15.000	23.000	42.000
BigN	0.916	0.278	1.000	1.000	1.000	0.915	0.280	1.000	1.000	1.000
Board size	8.986	1.931	8.000	9.000	10.000	8.988	1.933	8.000	9.000	10.000
CEO duality	0.514	0.500	0.000	1.000	1.000	0.517	0.500	0.000	1.000	1.000
DACC	0.102	0.128	0.023	0.056	0.124	0.102	0.128	0.023	0.056	0.124
Delaware	0.648	0.478	0.000	1.000	1.000	0.643	0.479	0.000	1.000	1.000
EarnVol	0.036	0.035	0.014	0.025	0.045	0.035	0.034	0.013	0.025	0.044
Fog	21.144	1.575	20.072	21.052	22.118					
INDEP	0.641	0.167	0.556	0.700	0.778	0.641	0.168	0.556	0.700	0.778
Loss	0.151	0.358	0.000	0.000	0.000	0.148	0.355	0.000	0.000	0.000
M&A	0.303	0.459	0.000	0.000	1.000					
MTB	1.991	1.143	1.239	1.640	2.333	1.967	1.117	1.234	1.633	2.293
NBSeg	1.221	0.463	0.693	1.386	1.609					
NegEC	0.429	0.495	0.000	0.000	1.000	0.428	0.495	0.000	0.000	1.000
NGSeg	1.362	0.505	1.099	1.386	1.792					
REM	0.007	0.013	0.000	0.002	0.007	0.007	0.013	0.000	0.002	0.007
RetVol	0.099	0.049	0.064	0.088	0.121	0.098	0.049	0.064	0.088	0.120
SEO	0.046	0.209	0.000	0.000	0.000					
Size	7.887	1.507	6.825	7.740	8.859					
SPI	-0.014	0.037	-0.013	-0.003	0.000	-0.014	0.036	-0.013	-0.003	0.000
Observations	6,395					6,194				

This table reports descriptive statistics of the main variables used in the analysis of hypothesis 1 and 2 (full sample) and hypothesis 3 (abnormal readability sample). All continuous variables are winsorized at 1% and 99% of the distribution. For detailed variable definitions see **Appendix A**.

In **Appendix B**, a Pearson correlation matrix is included. The correlation of the Fog and the proportion of independent directors minus the proportion of inside directors is positive and significant. The correlation of the Fog and CEO duality is negative and significant, which lends some preliminary evidence against the hypothesized relation between board independence and readability. Although most correlations are statistically significant, the magnitudes are mostly small, indicating multicollinearity is not likely to be a problem. This assumption is verified by calculating the generalized variance inflation factors (GVIF), which assure multicollinearity is not a problem. The GVIF scores can be found in **Appendix C**.

4. Empirical results and analysis

4.1. Board independence and MD&A readability

I first test if board independence has a positive effect on the readability of the MD&A (**H1**). Since a higher Fog indicates a less readable MD&A, I expect firms with a more independent board to have a lower Fog. Therefore, the expected sign of $INDEP_{it}$ is negative, and the expected sign of $CEO\ duality_{it}$ is positive. Having more independent directors compared to inside directors on the board is expected to decrease the Fog. Having a CEO who is also chairman of the board of directors is expected to increase to Fog. The predicted signs for the various control variables are derived from the predicted signs in Li (2008) and Lo et al. (2017). However, when their empirical findings differ, no prediction is made. In addition, I

Table 4
The effect of board independence on readability and the role of bad news.

Independent variable	Predicted sign	H1	H2	
		(1)	(2) Loss	(3) NegEC
CEO duality	+	**-0.086**	-0.076	-0.110
		(-1.238)	(-1.037)	(-1.396)
INDEP	−	**0.302**	0.233	0.225
		(1.280)	(0.923)	(0.818)
CEO duality × Bad news	+		**-0.055**	**0.055**
			(-0.439)	**(0.768)**
INDEP × Bad news	−		**0.483**	**0.173**
			(1.283)	**(0.817)**
Age	?	-0.005	-0.005	-0.005
		(-1.453)	(-1.443)	(-1.45)
BigN	−	-0.111	-0.112	-0.110
		(-0.947)	(-0.955)	(-0.944)
Board size	?	0.002	0.002	0.002
		(0.077)	(0.069)	(0.074)
DACC	+	-0.292	-0.295	-0.290
		(-1.629)	(-1.637)	(-1.611)
Delaware	+	0.200**	0.201**	0.200**
		(2.286)	(2.297)	(2.288)
EarnVol	+	1.619	1.637	1.637
		(1.609)	(1.628)	(1.626)
Loss	+	0.305***	0.022	0.307***
		(3.869)	(0.083)	(3.881)
M&A	?	0.005	0.005	0.004
		(0.086)	(0.084)	(0.066)
MTB	+	-0.122***	-0.122***	-0.123***
		(-3.285)	(-3.293)	(-3.306)
NBSeg	?	0.101	0.103	0.101
		(1.102)	(1.123)	(1.099)
NegEC	+	0.013	0.014	-0.127
		(0.362)	(0.376)	(-0.881)
NGSeg	?	0.119	0.122	0.118
		(1.344)	(1.380)	(1.340)
REM	+	8.636***	8.650***	8.616***
		(4.462)	(4.465)	(4.450)
RetVol	+	2.985***	2.996***	2.973***
		(4.773)	(4.794)	(4.753)
SEO	?	0.166	0.162	0.166
		(1.642)	(1.595)	(1.640)
Size	?	0.225***	0.225***	0.226***
		(5.647)	(5.663)	(5.654)
SPI	?	-0.050	-0.032	-0.055
		(-0.081)	(-0.052)	(-0.090)
Constant		15.755***	15.788***	15.826***
		(37.717)	(37.420)	(36.946)
Year & industry fixed effects		Yes	Yes	Yes
Observations		6,395	6,395	6,395
Adjusted R^2		0.245	0.245	0.245

This table shows the regression results of **H1** and **H2**, where the dependent variable is the Fog index of the MD&A. Column (1) shows the regression results for **H1**, and column (2) and (3) show the regression results of **H2**, where in column (2) bad news is defined as a loss-making firm-year and in column (3) bad news is defined as a firm-year with negative earnings change. Predicted signs are derived from the predicted signs by Li (2008) and Lo et al. (2017), however, when predicted signs differ from empirical results the predicted sign is listed as "?". All continuous variables are winsorized at 1% and 99% of the distribution and detailed variable definitions can be found in **Appendix A**. Standard errors are clustered at firm level. T-statistics are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level (two-tailed test).

expect the sign of BigN to be negative, whereas there is no predicted sign for board size. Furthermore, the coefficients of the absolute values of the earnings management measures are expected to be positive, indicating a less readable MD&A.

I then estimate equation **(3)** using the Fog of the MD&A as the dependent variable and the full set of control variables. The regression results in **Table 4** column (1) show that the proportion of independent directors minus the proportion of inside directors has a positive but insignificant effect on the Fog of the MD&A (β = 0.302, *p*-value > 0.10). The indicator variable for CEO duality has a negative and insignificant effect on the Fog of the MD&A (β = -0.086, *p*-value > 0.10). This result indicates that the null hypothesis, that board independence has no effect on MD&A readability, cannot be rejected.

Of the control variables, only loss, market-to-book, real earnings management, return volatility, and size are significant at the 1% level, while the indicator variable for Delaware is significant at the 5% level. Market-to-book shows an unpredicted negative sign (β = -0.122, *p*-value < 0.01) and size shows a positive sign (β = 0.225, *p*-value < 0.01). Although Li (2008) predicts a positive effect of size on the textual complexity of the MD&A, he does not find a significant effect. Lo et al. (2017) do not find a significant effect of size either. The highly significant effect of size on readability is therefore somewhat unexpected but may be explained by the difference in average firm size between the samples. The coefficients of loss, real earnings management are significantly positive, which is in line with the main findings of Li (2008) and Lo et al. (2017). Although the coefficient of real earnings management seems large (β = 8.636), the effect is economically insignificant. Increasing a firm's real earnings management from 0.000 (25th percentile of the sample) to 0.007 (75th percentile of the sample) only leads to an increase of the Fog of 0.060. Return volatility and the indicator variable for firms incorporated in Delaware are also significantly positive, consistent with Li (2008) and Lo et al. (2017).

Overall, I do not find evidence that suggests board independence has a positive effect on readability. Contrary to the hypothesized relation, I find that board independence has a negative but statistically insignificant effect on readability. A possible explanation for this negative effect may be that inside directors have more knowledge and expertise. Because of this, they are able to disclose information in a more understandable manner. This relation may also explain why the effect of board independence is statistically insignificant. If, as hypothesized, independent boards decrease management obfuscation, then independent boards would increase readability. However, if independent boards simultaneously decrease readability because of inferior knowledge and expertise compared to inside directors, the relation between board independence and readability becomes much less clear. These simultaneous counteracting effects may explain the insignificant results.

4.2. The role of bad news

To test if the predicted positive effect of board independence on readability increases when firms report bad news (**H2**), I interact bad news with $INDEP_{it}$ and $CEO\ duality_{it}$. $Bad\ news_{it}$ is defined as either a loss-making firm-year or a firm-year with negative earnings change. **Table 4** column (2) shows the regression results where bad news is defined as a loss-making firm-year. The interaction effect of bad news and the proportion of independent directors minus the proportion of inside directors is positive and insignificant (β = 0.483, *p*-

value > 0.10). The interaction effect of bad news and CEO duality is negative and insignificant (β = -0.055, *p*-value > 0.10). Which is inconsistent with the hypothesized relation. Introducing the interaction terms reduces the coefficient of Loss to 0.022 and makes its effect insignificant (*p*-value > 0.10). The effects of the control variables are similar in size and significance to the results found in column (1) of **Table 4**.

Table 4 column (3) shows the regression results where bad news is defined as a firm-year with negative earnings change. The interaction effect of bad news and the proportion of independent directors minus the proportion of inside directors is positive and insignificant (β = 0.173, *p*-value > 0.10). The interaction effect of bad news and CEO duality is also positive and insignificant (β = 0.055, *p*-value > 0.10). The other variables are again similar in size and significance to the previous analyses.

Overall the results show no increase in the effect of board independence when a firm reports bad news. This result is consistent for the two definitions of bad news that are employed. The null hypothesis that bad news does not affect the effect of board independence on readability cannot be rejected.

4.3. Board independence and MD&A obfuscation

To test if board independence decreases obfuscation of the MD&A (**H3**), I first estimate equation **(2)** to calculate abnormal readability, using the Fog as the dependent variable. The abnormal Fog index proxies for the obfuscation component of readability. I then estimate equation **(3)** using the abnormal Fog of the MD&A as the dependent variable and employ a reduced set of control variables. The included controls are limited to variables not used in estimating the abnormal Fog. Year- and industry-fixed effects are still included in the regression.

Table 5 shows the results of regressing the abnormal Fog on board independence and the selection of control variables. The effect of the proportion of independent directors minus the proportion of inside directors on abnormal readability is positive and insignificant (β = 0.192, *p*-value > 0.10). The indicator variable for CEO duality has a negative and insignificant effect on abnormal readability (β = -0.015, *p*-value > 0.10). This finding indicates that the null hypothesis that board independence does not affect MD&A obfuscation cannot be rejected.

Of the control variables, only the indicator variable for firms incorporated in Delaware and return volatility are statistically significant at the 5% and 1% level, respectively. Both have a negative effect on abnormal readability. While this seems to indicate that these factors increase the amount of obfuscation, I suspect the measure of abnormal readability as proposed by Rjiba et al. (2021) is actually misspecified. Firms incorporated in Delaware are subject to different regulatory requirements, which may cause an increase in readability (Li, 2008). Similarly, return volatility indicates a more volatile business which may increase the complexity of disclosures and cause a decrease in readability. In an untabulated test, I include both measures in equation **(2)** to calculate the abnormal Fog and then rerun equation **(3)**. The results of this test are qualitatively similar.

Overall, I do not find evidence that suggests board independence has a negative effect on obfuscation. Rather, I find that board independence has a positive effect on obfuscation. However, the effect is statistically insignificant.

Table 5
The effect of board independence on abnormal readability.

Independent variable	Predicted sign	
CEO duality	+	**-0.015**
		(-0.220)
INDEP	−	**0.192**
		(0.815)
Age	?	-0.004
		(-1.191)
BigN	−	-0.137
		(-1.230)
Board size	?	0.020
		(0.968)
DACC	+	-0.032
		(-0.180)
Delaware	+	0.177**
		(2.076)
EarnVol	+	-0.406
		(-0.405)
Loss	+	0.052
		(0.691)
MTB	+	-0.015
		(-0.465)
NegEC	+	-0.003
		(-0.079)
REM	+	2.163
		(1.103)
RetVol	+	1.907***
		(2.870)
SPI	?	0.030
		(0.049)
Constant		-0.421
		(-1.265)
Year & industry fixed effects		Yes
Observations		6,194
Adjusted R^2		-0.001

This table shows the regression results for **H3**, where the abnormal Fog index is the dependent variable. Predicted signs are derived from the predicted signs by Li (2008) and Lo et al. (2017), however, when predicted signs differ from empirical results the predicted sign is listed as "?". All continuous variables are winsorized at 1% and 99% of the distribution and detailed variable definitions can be found in **Appendix A**. Standard errors are clustered at firm level. T-statistics are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level (two-tailed test).

5. Robustness checks

5.1. Alternative readability measures

To study the sensitivity of my results to alternative measures of readability, I redo my analysis using three different measures of readability. In addition to the Fog index, I employ the Flesch reading ease score, the Flesch-Kincaid readability score, and the length of the MD&A as measures of readability.

Table 6 shows the regression results for **H1** and **H2** with length as the dependent variable, which is measured as the natural logarithm of the number of words in the MD&A. Whereas the proportion of independent directors minus the proportion of inside directors does not have a significant effect on the Fog of the MD&A, it does have a positive and significant effect on the length of the MD&A ($\beta = 0.239$, p-value < 0.05). On average, firms with more

Table 6
The effect of board independence on the length of the MD&A and the role of bad news.

Independent variable	Predicted sign	H1	H2	
		(1)	(2) Loss	(3) NegEC
CEO duality	+	**-0.017**	-0.017	-0.026
		(-0.603)	(-0.548)	(-0.781)
INDEP	−	**0.239****	0.226**	0.273**
		(2.462)	(2.164)	(2.301)
CEO duality × Bad news	+		**0.003**	**0.020**
			(0.084)	**(0.795)**
INDEP × Bad news	−		**0.097**	**-0.075**
			(0.696)	**(-0.954)**
Age	?	0.000	0.000	0.000
		(0.313)	(0.323)	(0.308)
BigN	−	0.043	0.043	0.042
		(1.120)	(1.112)	(1.089)
Board size	?	0.014	0.014	0.014
		(1.517)	(1.515)	(1.530)
DACC	+	-0.078	-0.078	-0.078
		(-1.240)	(-1.245)	(-1.238)
Delaware	+	0.066*	0.067*	0.066*
		(1.690)	(1.699)	(1.688)
EarnVol	+	-0.153	-0.149	-0.154
		(-0.473)	(-0.462)	(-0.479)
Loss	+	0.052*	-0.011	0.052*
		(1.779)	(-0.122)	(1.796)
M&A	?	0.034	0.034	0.034
		(1.312)	(1.307)	(1.293)
MTB	+	-0.055***	-0.055***	-0.055***
		(-4.217)	(-4.229)	(-4.192)
NBSeg	?	0.066*	0.067*	0.066*
		(1.725)	(1.741)	(1.730)
NegEC	+	-0.020	-0.020	0.017
		(-1.468)	(-1.467)	(0.320)
NGSeg	?	0.024	0.025	0.024
		(0.624)	(0.635)	(0.623)
REM	+	0.833	0.835	0.828
		(1.424)	(1.427)	(1.417)
RetVol	+	1.036***	1.036***	1.032***
		(4.833)	(4.812)	(4.815)
SEO	?	0.056	0.055	0.056
		(1.535)	(1.509)	(1.543)
Size	?	0.042**	0.042**	0.042**
		(2.093)	(2.095)	(2.092)
SPI	?	-0.311*	-0.309*	-0.318*
		(-1.662)	(-1.650)	(-1.689)
Constant		8.684***	8.694***	8.667***
		(43.486)	(43.398)	(43.863)
Year & industry fixed effects		Yes	Yes	Yes
Observations		6,395	6,395	6,395
Adjusted R^2		0.125	0.125	0.125

This table shows the robustness check of **H1** and **H2**, where the dependent variable is the length of the MD&A. Column (1) shows the regression results for **H1**, and column (2) and (3) show the regression results of **H2**, where in column (2) bad news is defined as a loss-making firm-year and in column (3) bad news is defined as a firm-year with negative earnings change. Predicted signs are derived from the predicted signs by Li (2008) and Lo et al. (2017), however, when predicted signs differ from empirical results the predicted sign is listed as "?". All continuous variables are winsorized at 1% and 99% of the distribution and detailed variable definitions can be found in **Appendix A**. Standard errors are clustered at firm level. T-statistics are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level (two-tailed test).

independent directors compared to inside directors have lengthier MD&A's. A 1% increase in independence leads to a 0,27% increase in length. On a board with a median board size of 9 directors, replacing one inside director with an independent director results in a 6,0% increase in the length of the MD&A. The effect of CEO duality on length is negative but insignificant (β = -0.017, *p*-value > 0.10). These results indicate that **H1**, that board independence has a positive effect on the readability of the MD&A, can be rejected. When the interaction effects of **H2** are introduced in **Table 6** column (2) and column (3), the effects of the board independence measures on length are similar in size and significance. The interaction terms themselves, however, are insignificant.

Appendix D column (1) shows the regression results for **H3** with abnormal length as the dependent variable. The proportion of independent directors minus the proportion of inside directors has a significant positive effect on the abnormal length of the MD&A. This finding indicates that firms with more independent directors compared to inside directors are more likely to obfuscate the MD&A. The effect of CEO duality is again insignificant. Still, these results provide some indication that **H3**, that board independence has a negative effect on MD&A obfuscation, can be rejected.

Appendix E shows the results of **H1** and **H2** for the Flesch reading ease score. Since a higher Flesch reading ease score indicates that a text is more difficult the read, the predicted signs are reversed. With regard to the main variables of interest, the results remain qualitatively similar to the main analysis. However, the effect of discretionary accruals on readability now becomes positive and significant (β = 0.979, *p*-value < 0.10), indicating that firms that engage in accrual-based earnings management have MD&A's that are easier to read. This effect remains when the interaction effects are added in column (2) and column (3). **Appendix G** shows the regression results for **H3** with the abnormal Flesch as the dependent variable. However, the findings are qualitatively similar to the main analysis.

Appendix G shows the results of **H1** and **H2** with the Flesch-Kincaid readability score as the dependent variable, and **Appendix D** column (2) shows the regression results for **H3** with the abnormal Flesch-Kincaid readability score as the dependent variable. The findings of both analyses are qualitatively similar to the main analyses.

Overall, the additional tests using a variety of measures for readability provide some evidence of a negative relation between board independence and readability. When the length of the MD&A is considered as a measure of readability, the negative effect of board independence on readability and obfuscation becomes both statistically and economically significant.

5.2. Alternative measure for board independence

To test if my results are affected by the definition of board structure, I redo my analysis using the proportion of independent directors instead of the proportion of independent directors minus the proportion of inside directors. **Appendix H** shows the results of **H1** and **H2** for this alternative definition of board structure. The findings are similar to the main analysis, except for the interaction effect of bad news and the proportion of independent directors when bad news is defined as a loss-making firm-year in column (2). This interaction has a positive and significant effect on the Fog of the MD&A (β = 1.008, *p*-value < 0.10). For a loss-making firm-year, a 1% increase in independence leads to a 0.01 increase of the Fog. On a board with a

Table 7
The effect of board independence on the Fog of the MD&A using standard errors clustered at the industry-level.

Independent variable	Predicted sign	H1	H2	
		(1)	(2) Loss	(3) NegEC
CEO duality	+	**-0.086***	-0.076	-0.110**
		(-1.865)	(-1.581)	(-2.112)
INDEP	−	**0.302**	0.233	0.225
		(1.251)	(0.936)	(0.836)
CEO duality × Bad news	+		**-0.055**	**0.055**
			(-0.495)	**(0.834)**
INDEP × Bad news	−		**0.483**	**0.173**
			(1.289)	**(0.809)**
Age	?	-0.005	-0.005	-0.005
		(-1.374)	(-1.360)	(-1.368)
BigN	−	-0.111	-0.112	-0.110
		(-0.986)	(-0.992)	(-0.990)
Board size	?	0.002	0.002	0.002
		(0.081)	(0.073)	(0.077)
DACC	+	-0.292**	-0.295**	-0.290*
		(-1.978)	(-2.002)	(-1.943)
Delaware	+	0.200***	0.201***	0.200***
		(2.610)	(2.616)	(2.610)
EarnVol	+	1.619	1.637	1.637
		(1.545)	(1.568)	(1.569)
Loss	+	0.305***	0.022	0.307***
		(2.985)	(0.069)	(3.019)
M&A	?	0.005	0.005	0.004
		(0.084)	(0.083)	(0.065)
MTB	+	-0.122*	-0.122*	-0.123*
		(-1.933)	(-1.946)	(-1.933)
NBSeg	?	0.101	0.103	0.101
		(1.375)	(1.400)	(1.372)
NegEC	+	0.013	0.014	-0.127
		(0.361)	(0.373)	(-0.875)
NGSeg	?	0.119*	0.122**	0.118*
		(1.914)	(1.973)	(1.913)
REM	+	8.636***	8.650***	8.616***
		(6.652)	(6.690)	(6.629)
RetVol	+	2.985***	2.996***	2.973***
		(4.987)	(5.063)	(4.980)
SEO	?	0.166*	0.162*	0.166*
		(1.831)	(1.796)	(1.820)
Size	?	0.225***	0.225***	0.226***
		(5.065)	(5.103)	(5.075)
SPI	?	-0.050	-0.032	-0.055
		(-0.074)	(-0.047)	(-0.081)
Constant		15.755***	15.788***	15.826***
		(39.757)	(39.081)	(39.352)
Year & industry fixed effects		Yes	Yes	Yes
Observations		6,395	6,395	6,395
Adjusted R^2		0.245	0.245	0.245

This table shows the robustness check of **H1** and **H2**, where the dependent variable is the Fog index of the MD&A and where standard errors are clustered at the industry-level (two-digit SIC). Column (1) shows the regression results for **H1**, and column (2) and (3) show the regression results of **H2**, where in column (2) bad news is defined as a loss-making firm-year and in column (3) bad news is defined as a firm-year with negative earnings change. Predicted signs are derived from the predicted signs by Li (2008) and Lo et al. (2017), however, when predicted signs differ from empirical results the predicted sign is listed as "?". All continuous variables are winsorized at 1% and 99% of the distribution and detailed variable definitions can be found in **Appendix A**. T-statistics are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level (two-tailed test).

median board size of 9 directors, replacing one inside director with an independent director results in a 0.112 increase of the Fog when a firm reports a loss that year. This finding provides some evidence against **H2**, which states that the positive effect of board independence on readability increases when firms report bad news. **Appendix I** shows the results for **H3** using the proportion of independent directors. However, the results are qualitatively similar to the main analysis.

5.3. Clustering standard errors by industry

To test if my results are robust to the method of standard error clustering applied, I redo my analysis using standard errors clustered by industry instead of by firm. Both Li (2008) and Lo et al. (2017) cluster standard errors at the industry-level instead of at the firm-level. **Table 7** shows the results of **H1** and **H2** with standard errors clustered at the two-digit SIC level. In column (1) the effect of CEO duality on the Fog becomes negative and significant (β = -0.086, *p*-value < 0.10). Firms with a CEO who is also chairman of the board have, on average more readable MD&A's. The effect, however, is economically insignificant. Still, it provides some evidence against **H1**, which states that board independence has a positive effect on the readability of the MD&A. Furthermore, the effect of discretionary accruals becomes negative and significant (β = -0.292, *p*-value < 0.05). This finding indicates that firms that engage in accrual-based earnings management have more readable MD&A's. **Appendix J** shows the result of **H3** with standard errors clustered at the industry-level. However, the results are qualitatively similar to the main analysis.

6. Conclusion

In this study, I analyze the effect of board independence on the readability of a firm's management discussion and analysis. I use a sample consisting of 6,395 firm-year observations of S&P 1500 firms during the period 2007-2019. Using the Fog index as a measure of readability and CEO duality and the proportion of independent directors minus the proportion of inside directors as measures of board independence, I find no clear relation between board independence and readability.

Although the main analysis does not show a statistically significant effect of board independence, additional tests using alternative readability scores, alternative independence measures, and an alternative standard error clustering method show some indication of a negative relation between board independence and readability. Contrary to the hypothesized relation, board independence seems to decrease the readability of the MD&A. This is especially the case when the length of the MD&A is considered. On a board with a median board size of 9 directors, replacing one inside director with an independent director results in a 6,0% increase in the length of the MD&A. This effect is both statistically and economically significant. This effect also holds when I consider only the obfuscation component of readability. The main analysis shows a positive but insignificant effect of board independence on MD&A obfuscation. However, when I consider the length of the MD&A as a measure of readability the effect becomes significantly positive, indicating that independent boards are more likely to obfuscate information using lengthier disclosures. The combined effect of board independence and bad news on the readability of the MD&A is largely negative and insignificant.

Taken together, these findings cast some doubts on management obfuscation theory, which states that management may be motivated to increase information processing costs by decreasing readability. If management would indeed behave opportunistically and obfuscate information, an independent board would increase readability. Since my findings provide some evidence that indicates that board independence actually decreases readability, one could question if management truly does obfuscate information. Instead, following stewardship theory, management may be intrinsically motivated to act in the firm's best interest and thus not obfuscate information. The insider-dominated board no longer has to protect shareholders against opportunistic managerial behavior but can exercise its superior knowledge and expertise to increase readability. This explanation would be consistent with my findings.

Additional tests also reveal some indications of a positive effect of discretionary accruals on readability. These results seem contradictory to the findings of Lo et al. (2017). One possible explanation is that firms only obfuscate accrual-based earnings management that is income-increasing in nature. The negative effect of real earnings management on readability is consistent with the findings of Lo et al. (2017).

The main limitation of this paper is the measures of readability used. The Fog index, Flesch-Kincaid readability score, and the Flesch reading ease score all require calculating the number of complex words per sentence, where complex words are defined as words consisting of three syllables or more. As Loughran and McDonald (2014) argue, this means readability measures are often misspecified when applied to financial disclosures since easily understood words like *industry*, *company*, and *management* are classified as complex. Length, on the other hand, is likely to be correlated with the amount of disclosure (Li, 2008). Given these limitations, Bonsall et al. (2017) propose the Bog index, which measures readability based on the SEC's plain English guidelines. This measure, however, was not available.[3] To assure the results are not affected by potential misspecification of the readability measures, I employ a wide range of readability measures in additional tests. While the significance of the coefficients does vary for the different readability measures, the signs of the coefficients do not and consistently indicate a negative effect of board independence on readability.

A second limitation is that boards may already be too independent. After reaching a certain threshold, like an independent majority, the added value of an independent director may decrease. If such a nonlinear relation of diminishing returns does indeed describe the relation between board independence and readability, the results provide some indications that the current level of board independence is too high when it comes to readability. This explanation would be consistent with Byrd and Hickman (1992), who also argue that too much independence may be problematic.

My findings also have implications for shareholders and regulators. While previous literature has associated independent boards with higher audit quality and higher financial reporting quality, my findings indicate lower disclosure quality as measured by the readability of the MD&A. Given the adverse consequences associated with low readability, regulators and shareholders should carefully consider whether board independence is something to be strived

[3] The software used for calculating the Bog index can only be accessed by buying StyleWriter. Still, Brian Miller provides free access to a database with Bog indexes of 10-K filings on his website. However, this does not allow me to measure the readability of solely the management discussion and analysis.

for. Especially regulators should consider this carefully since mainly small and individual investors are affected by low readability, which is coincidentally also a group that often requires extra protection from regulators.

Still, my findings should be interpreted with caution. While several tests indicate a negative relation between board independence and readability, the results are not consistent in terms of statistical significance. Future research could extend the sample beyond S&P 1500 firms to attain such significance. While previous studies focused on earnings properties as determinants of readability, my research is one of the first to examine the relation between corporate governance and readability. Future research may examine the effect of other elements of corporate governance on readability.

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8. Appendix A

Table 8

Variable definitions.

Variable	Description	Data source
<u>Readability Variables</u>		
AbFlesch	Abnormal Flesch reading ease score, calculated as the residual from regressing the Flesch reading ease score on several complexity variables	Own computation
AbFlesch-Kincaid	Abnormal Flesch-Kincaid readability score, calculated as the residual from regressing the Flesch-Kincaid readability score on several complexity variables	Own computation
AbFog	Abnormal Gunning Fog index, calculated as the residual from regressing the Gunning Fog index on several complexity variables	Own computation
AbLength	Abnormal Length of the MD&A, calculated as the residual from regressing Length on several complexity variables	Own computation
Flesch	Flesch reading ease score = 206.853 – (1.015 * average words per sentence) – (84.6 * average amount of syllables per word)	Own computation from SEC Edgar
Flesch-Kincaid	Flesch-Kincaid readability score = (0.39 * average words per sentence) + (11.8 * average amount of syllables per word) – 15.59	Own computation from SEC Edgar
Fog	Gunning Fog index = 0.4 * (average words per sentence + percentage of complex words), where complex words are defined as words consisting of 3 syllables or more	Own computation from SEC Edgar
Length	Natural logarithm of the number of words in the MD&A	Own computation from SEC Edgar
<u>Board Independence Variables</u>		
CEO duality	Indicator variable that is equal to 1 if the CEO is also chairman of a firm's board of directors, and 0 otherwise	ExecuComp
INDEP	The fraction of independent directors on a firm's board of directors minus the fraction of insider directors on a firm's board of directors. In an additional analysis I also measure INDEP as the fraction of independent directors on a firm's board of directors	ISS
<u>Control Variables</u>		
Age	If available, number of years since IPO, otherwise number of years since first appearance in *Compustat Security Monthly*	Compustat
BigN	Indicator variable that is equal to 1 if a firm is audited by the big four, and 0 otherwise	Compustat
Board size	Number of directors on a firm's board of directors	ISS
DACC	Absolute value of discretionary accruals based on the Jones (1991) model, where total accruals are calculated following the cash flow statement approach as suggested by Hribar and Collins (2002)	Compustat
Delaware	Indicator variable that is equal to 1 if a firm is incorporated in Delaware, and 0 otherwise	Compustat
EarnVol	Standard deviation of operating earnings in the prior 5 fiscal years scaled by book value of assets	Compustat
Loss	Indicator variable that is equal to 1 if a firm reports a loss, and 0 otherwise	Compustat
M&A	Indicator variable that is equal to 1 if a firm appears as an acquirer in Zephyr that year, and 0 otherwise	Zephyr

MTB	Market value of a firm divided by its book value	Compustat
NBSeg	Natural logarithm of 1 plus the number of business segments	Compustat
NegEC	Indicator variable that is equal to 1 if a firm reports lower earnings than the prior year, and 0 otherwise	Compustat
NGSeg	Natural logarithm of 1 plus the number of geographic segments	Compustat
REM	Level of real earnings management measured as the absolute sum of change in R&D expenses and change in advertising expenses divided by beginning total assets	Compustat
RetVol	Firm specific stock return volatility measured as the standard deviation of monthly stock returns in the prior year	Compustat
SEO	Indicator variable equal to 1 if a firm has a common equity offering that year, and 0 otherwise. A firm is assumed to have a common equity offering if its gross equity issuance that year is larger than 3% of its average market value of equity following Belo, Lin and Yang (2019)	Compustat
Size	Natural logarithm of a firm's market value of equity at the end of the fiscal year	Compustat
SPI	Special items scaled by book value of assets	Compustat
Expected Readability Variables		
Acq	Acquisitions scaled by total assets	Compustat
BTM	Book value of equity scaled by market value of equity at the beginning of the year	Compustat
CapEx	Capital expenditures scaled by total assets at the beginning of the year	Compustat
CapInt	Net plant, property and equipment scaled by total assets at the beginning of the year	Compustat
CFVol	Standard deviation of cash flows from operations over the prior five years scaled by total assets	Compustat
Financing	Amount raised from stock and debt issuances during the year scaled by total assets	Compustat
GWImp	Indicator variable equal to 1 if a firm reports a goodwill impairment charge that fiscal year, and 0 otherwise	Compustat
Leverage	Financial leverage measured as a firm's long-term debt plus short-term debt scaled by total assets	Compustat
R&D	Research and development expenses scaled by sales	Compustat
Restr	Indicator variable equal to 1 if a firm reports a restructuring charge that fiscal year, and 0 otherwise	Compustat
Return	The buy-and-hold return in the year of the 10-K filing	Compustat

9. Appendix B

Table 9

Pearson correlation matrix (N=6,395).

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Age	1																			
2. BigN	**0.08**	1																		
3. Board size	**0.35**	**0.25**	1																	
4. CEO duality	**0.10**	0.00	**0.07**	1																
5. DACC	**-0.05**	-0.02	**-0.03**	0.00	1															
6. Delaware	**-0.24**	0.00	**-0.10**	**-0.05**	0.03	1														
7. EarnVol	**-0.19**	**-0.11**	**-0.20**	**-0.11**	**0.09**	**0.08**	1													
8. Fog	0.02	0.02	**0.08**	**-0.06**	0.01	**0.09**	0.00	1												
9. INDEP	**0.25**	**0.20**	**0.27**	0.02	-0.03	0.02	**-0.08**	**0.09**	1											
10. Loss	**-0.10**	**-0.06**	**-0.10**	**-0.10**	**0.08**	**0.06**	**0.18**	**0.07**	-0.02	1										
11. M&A	**0.13**	**0.07**	**0.21**	-0.03	0.00	0.02	**-0.08**	**0.14**	**0.09**	**-0.08**	1									
12. MTB	**-0.12**	**-0.08**	**-0.08**	-0.01	**0.06**	**0.06**	**0.10**	0.02	**-0.09**	**-0.19**	**0.16**	1								
13. NBSeg	**0.32**	**0.10**	**0.21**	**0.04**	-0.01	**-0.07**	**-0.19**	**0.04**	**0.14**	**-0.04**	**0.05**	**-0.18**	1							
14. NegEC	-0.01	0.00	-0.02	-0.01	0.01	0.01	0.02	0.00	-0.01	**0.28**	**-0.04**	**-0.19**	0.00	1						
15. NGSeg	**0.08**	**0.04**	0.02	-0.01	**0.07**	**0.13**	-0.03	0.03	**0.09**	0.01	**0.08**	**0.04**	**0.15**	0.03	1					
16. REM	**-0.19**	**-0.09**	**-0.14**	**-0.06**	**0.08**	**0.09**	**0.27**	**0.09**	**-0.06**	**0.14**	-0.02	**0.24**	**-0.19**	0.01	**0.07**	1				
17. RetVol	**-0.23**	**-0.08**	**-0.22**	**-0.08**	**0.10**	**0.07**	**0.29**	**-0.04**	**-0.12**	**0.35**	**-0.17**	**-0.19**	**-0.12**	**0.10**	**-0.04**	**0.16**	1			
18. SEO	-0.02	-0.01	-0.02	-0.02	**0.03**	-0.01	**0.08**	**0.06**	0.00	**0.09**	-0.02	**-0.04**	-0.01	-0.01	**-0.06**	**0.05**	**0.11**	1		
19. Size	**0.29**	**0.25**	**0.52**	**0.12**	**-0.06**	0.02	**-0.18**	**0.18**	**0.21**	**-0.29**	**0.40**	**0.33**	**0.16**	**-0.12**	**0.17**	**-0.04**	**-0.46**	-0.02	1	
20. SPI	**0.04**	-0.02	0.02	**0.08**	**-0.11**	-0.03	-0.02	-0.03	**-0.03**	**-0.51**	0.02	**0.13**	-0.02	**-0.28**	**-0.04**	**-0.10**	**-0.19**	0.00	**0.15**	1

This table shows the correlation coefficients of Fog and firm characteristics for the full sample. Bolded coefficients are statistically significant at the 1% level. Variable definitions can be found in **Appendix A**.

10.Appendix C

Table 10

Generalized variance inflation factors.

		H1		H2 Loss		H2 NegEC		H3	
Variable	Df	$GVIF$	$GVIF^{\left(\frac{1}{2*Df}\right)}$	$GVIF$	$GVIF^{\left(\frac{1}{2*Df}\right)}$	$GVIF$	$GVIF^{\left(\frac{1}{2*Df}\right)}$	$GVIF$	$GVIF^{\left(\frac{1}{2*Df}\right)}$
CEO duality	1	1.125	1.060	1.307	1.143	1.883	1.372	1.115	1.056
INDEP	1	1.273	1.128	1.445	1.202	2.113	1.454	1.271	1.128
CEO duality × Bad news	1			1.876	1.370	2.834	1.683		
INDEP × Bad news	1			17.680	4.205	16.584	4.072		
Age	1	1.622	1.274	1.624	1.274	1.622	1.274	1.543	1.242
BigN	1	1.195	1.093	1.196	1.094	1.197	1.094	1.160	1.077
Board size	1	1.753	1.324	1.753	1.324	1.754	1.324	1.389	1.178
DACC	1	1.201	1.096	1.201	1.096	1.201	1.096	1.195	1.093
Delaware	1	1.228	1.108	1.229	1.108	1.228	1.108	1.207	1.099
EarnVol	1	1.437	1.199	1.437	1.199	1.438	1.199	1.434	1.198
Loss	1	1.698	1.303	19.347	4.399	1.700	1.304	1.665	1.291
Industry	51	7.879	1.020	8.158	1.021	8.037	1.021	3.675	1.013
M&A	1	1.592	1.262	1.592	1.262	1.593	1.262		
MTB	1	1.648	1.284	1.650	1.284	1.652	1.285	1.378	1.174
NBSeg	1	1.417	1.190	1.419	1.191	1.417	1.190		
NegEC	1	1.170	1.082	1.171	1.082	17.001	4.123	1.176	1.084
NGSeg	1	1.739	1.319	1.743	1.320	1.739	1.319		
REM	1	1.369	1.170	1.369	1.170	1.369	1.170	1.353	1.163
RetVol	1	2.041	1.429	2.043	1.429	2.043	1.429	1.864	1.365
SEO	1	1.081	1.040	1.083	1.041	1.081	1.040		
Size	1	2.760	1.661	2.760	1.661	2.760	1.661		
SPI	1	1.495	1.223	1.496	1.223	1.497	1.223	1.499	1.224
Year	12	2.305	1.035	2.311	1.036	2.316	1.036	1.739	1.023

This table shows the generalized variance inflation factors (GVIF) for the main regressions. For variables with 1 degree of freedom, GVIF and VIF are similar. GVIF^(1/(2*Df)) allows for comparison of variables with different degrees of freedom (Df). The high GVIF's for the interactions terms are no cause for concern. Variable definitions can be found in **Appendix A**.

11. Appendix D

Table 11

The effect of board independence on the abnormal length and the abnormal Flesch-Kincaid readability score.

Independent variable	Predicted sign	(1) Length	(2) Flesch-Kincaid
CEO duality	**+**	**0.001**	**-0.027**
		(0.029)	**(-0.431)**
INDEP	**−**	**0.165***	**0.165**
		(1.733)	**(0.770)**
Age	?	0.000	-0.003
		(0.060)	(-1.172)
BigN	−	0.020	-0.013
		(0.548)	(-0.129)
Board size	?	0.010	0.021
		(0.938)	(1.080)
DACC	+	-0.055	0.012
		(-0.881)	(0.071)
Delaware	+	0.052	0.149*
		(1.397)	(1.909)
EarnVol	+	0.016	-0.282
		(0.048)	(-0.306)
Loss	+	-0.008	0.030
		(-0.310)	(0.422)
MTB	+	-0.022*	-0.024
		(-1.938)	(-0.812)
NegEC	+	-0.020	0.000
		(-1.404)	(0.011)
REM	+	0.873	2.289
		(1.472)	(1.255)
RetVol	+	0.577**	1.840***
		(2.438)	(3.052)
SPI	?	-0.087	0.049
		(-0.460)	(0.086)
Constant		-0.281**	-0.477
		(-2.490)	(-1.598)
Year & industry fixed effects		Yes	Yes
Observations		6,194	6,194
Adjusted R^2		0.000	-0.001

This table show the robustness check for **H3**, where the abnormal readability score, the dependent variable, is defined as either the abnormal length of the MD&A (column (1)) or the abnormal Flesch-Kincaid readability score (column (2)). Predicted signs are derived from the predicted signs by Li (2008) and Lo et al. (2017), however, when predicted signs differ from empirical results the predicted sign is listed as "?". All continuous variables are winsorized at 1% and 99% of the distribution and detailed variable definitions can be found in **Appendix A**. Standard errors are clustered at firm level. T-statistics are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level (two-tailed test).

12.Appendix E

Table 12

The effect of board independence on the Flesch reading ease score of the MD&A and the role of bad news.

Independent variable	Predicted sign	H1	H2	
		(1)	(2) Loss	(3) NegEC
CEO duality	−	**0.316**	0.276	0.404
		(1.399)	(1.154)	(1.575)
INDEP	+	**-0.991**	-0.724	-0.604
		(-1.222)	(-0.825)	(-0.632)
CEO duality × Bad news	−		**0.224**	**-0.205**
			(0.573)	**(-0.889)**
INDEP × Bad news	+		**-1.852**	**-0.863**
			(-1.474)	**(-1.212)**
Age	?	0.017	0.017	0.017
		(1.628)	(1.618)	(1.624)
BigN	+	0.076	0.079	0.072
		(0.192)	(0.200)	(0.183)
Board size	?	-0.095	-0.095	-0.095
		(-1.235)	(-1.226)	(-1.233)
DACC	−	0.979*	0.989*	0.968*
		(1.706)	(1.717)	(1.683)
Delaware	−	-0.444	-0.448	-0.445
		(-1.573)	(-1.587)	(-1.577)
EarnVol	−	-1.607	-1.677	-1.686
		(-0.470)	(-0.490)	(-0.493)
Loss	−	-1.187***	-0.104	-1.194***
		(-4.825)	(-0.123)	(-4.843)
M&A	?	-0.043	-0.043	-0.038
		(-0.222)	(-0.221)	(-0.198)
MTB	−	0.423***	0.425***	0.428***
		(3.332)	(3.344)	(3.366)
NBSeg	?	-0.586*	-0.594*	-0.584*
		(-1.931)	(-1.956)	(-1.927)
NegEC	−	-0.036	-0.038	0.626
		(-0.308)	(-0.325)	(1.292)
NGSeg	?	-0.580*	-0.593**	-0.579*
		(-1.930)	(-1.973)	(-1.927)
REM	−	-28.901***	-28.956***	-28.820***
		(-4.567)	(-4.573)	(-4.554)
RetVol	−	-8.278***	-8.322***	-8.234***
		(-4.111)	(-4.135)	(-4.085)
SEO	?	-0.468	-0.449	-0.466
		(-1.476)	(-1.417)	(-1.470)
Size	?	-0.807***	-0.807***	-0.808***
		(-6.044)	(-6.065)	(-6.055)
SPI	?	-0.319	-0.387	-0.306
		(-0.174)	(-0.211)	(-0.168)
Constant		45.212***	45.087***	44.876***
		(33.003)	(32.587)	(32.020)
Year & industry fixed effects		Yes	Yes	Yes
Observations		6,395	6,395	6,395
Adjusted R^2		0.262	0.262	0.262

This table shows the robustness check of **H1** and **H2**, where the dependent variable is the Flesch reading ease score of the MD&A. Column (1) shows the regression results for **H1**, and column (2) and (3) show the regression results of **H2**, where in column (2) bad news is defined as a loss-making firm-year and in column (3) bad news is defined as a firm-year with negative earnings change. Predicted signs are derived from the predicted signs by Li (2008) and Lo et al. (2017), however, when predicted signs differ from empirical results the predicted sign is listed as "?". All continuous variables are winsorized at 1% and 99% of the distribution and detailed variable definitions can be found in **Appendix A**. Standard errors are clustered at firm level. T-statistics are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level (two-tailed test).

13. Appendix F

Table 13
The effect of board independence on the abnormal Flesch reading ease score.

Independent variable	Predicted sign	Flesch
CEO duality	−	**0.089**
		(0.398)
INDEP	+	**-0.644**
		(-0.802)
Age	?	0.016*
		(1.660)
BigN	+	0.199
		(0.529)
Board size	?	-0.138*
		(-1.928)
DACC	−	-0.041
		(-0.076)
Delaware	−	-0.353
		(-1.290)
EarnVol	−	2.592
		(0.773)
Loss	−	-0.378
		(-1.616)
MTB	−	0.061
		(0.546)
NegEC	−	0.035
		(0.288)
REM	−	-6.706
		(-1.067)
RetVol	−	-6.155***
		(-2.842)
SPI	?	-1.903
		(-1.033)
Constant		2.042*
		(1.885)
Year & industry fixed effects		Yes
Observations		6,194
Adjusted R^2		0.000

This table shows the robustness check for **H3**, where the abnormal Flesch reading ease score is the dependent variable. Predicted signs are derived from the predicted signs by Li (2008) and Lo et al. (2017), however, when predicted signs differ from empirical results the predicted sign is listed as “?”. Since higher values of the abnormal Flesch indicate less obfuscation, all signs are reversed. All continuous variables are winsorized at 1% and 99% of the distribution and detailed variable definitions can be found in **Appendix A**. Standard errors are clustered at firm level. T-statistics are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level (two-tailed test).

14.Appendix G

Table 14

The effect of board independence on the Flesch-Kincaid readability score and the role of bad news.

Independent variable	Predicted sign	H1	H2	
		(1)	(2) Loss	(3) NegEC
CEO duality	+	**-0.095**	-0.081	-0.114
		(-1.502)	(-1.217)	(-1.591)
INDEP	−	**0.270**	0.198	0.185
		(1.249)	(0.858)	(0.736)
CEO duality × Bad news	+		**-0.080**	**0.045**
			(-0.694)	**(0.663)**
INDEP × Bad news	−		**0.494**	**0.190**
			(1.445)	**(0.955)**
Age	?	-0.004	-0.004	-0.004
		(-1.392)	(-1.384)	(-1.388)
BigN	−	0.027	0.027	0.028
		(0.256)	(0.251)	(0.265)
Board size	?	0.007	0.007	0.007
		(0.353)	(0.342)	(0.349)
DACC	+	-0.181	-0.184	-0.179
		(-1.092)	(-1.107)	(-1.075)
Delaware	+	0.169**	0.170**	0.169**
		(2.125)	(2.137)	(2.128)
EarnVol	+	1.810*	1.828**	1.827**
		(1.950)	(1.970)	(1.967)
Loss	+	0.269***	-0.011	0.271***
		(3.684)	(-0.047)	(3.695)
M&A	?	0.011	0.011	0.010
		(0.194)	(0.196)	(0.177)
MTB	+	-0.124***	-0.125***	-0.125***
		(-3.710)	(-3.719)	(-3.735)
NBSeg	?	0.137	0.139	0.136
		(1.620)	(1.641)	(1.617)
NegEC	+	0.017	0.017	-0.129
		(0.485)	(0.507)	(-0.954)
NGSeg	?	0.146*	0.150*	0.146*
		(1.780)	(1.825)	(1.776)
REM	+	8.217***	8.233***	8.200***
		(4.537)	(4.539)	(4.526)
RetVol	+	2.850***	2.865***	2.840***
		(4.916)	(4.947)	(4.898)
SEO	?	0.149	0.144	0.149
		(1.546)	(1.495)	(1.543)
Size	?	0.206***	0.206***	0.206***
		(5.612)	(5.634)	(5.620)
SPI	?	-0.060	-0.041	-0.063
		(-0.105)	(-0.071)	(-0.110)
Constant		12.102***	12.131***	12.175***
		(30.779)	(30.595)	(30.253)
Year & industry fixed effects		Yes	Yes	Yes
Observations		6,395	6,395	6,395
Adjusted R^2		0.237	0.237	0.236

This table shows the robustness check of **H1** and **H2**, where the dependent variable is the Flesch-Kincaid readability score of the MD&A. Column (1) shows the regression results for **H1**, and column (2) and (3) show the regression results of **H2**, where in column (2) bad news is defined as a loss-making firm-year and in column (3) bad news is defined as a firm-year with negative earnings change. Predicted signs are derived from the predicted signs by Li (2008) and Lo et al. (2017), however, when predicted signs differ from empirical results the predicted sign is listed as "?". All continuous variables are winsorized at 1% and 99% of the distribution and detailed variable definitions can be found in **Appendix A**. Standard errors are clustered at firm level. T-statistics are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level (two-tailed test).

15.Appendix H

Table 15

The effect of board independence on the Fog of the MD&A and the role of bad news.

Independent variable	Predicted sign	H1	H2	
		(1)	(2) Loss	(3) NegEC
CEO duality	+	**-0.087**	-0.077	-0.110
		(-1.256)	(-1.049)	(-1.402)
INDEP	−	**0.446**	0.287	0.229
		(1.221)	(0.733)	(0.537)
CEO duality × Bad news	+		**-0.053**	**0.055**
			(-0.424)	**(0.760)**
INDEP × Bad news	−		**1.008***	**0.483**
			(1.683)	**(1.386)**
Age	?	-0.005	-0.004	-0.004
		(-1.442)	(-1.422)	(-1.433)
BigN	−	-0.104	-0.105	-0.104
		(-0.883)	(-0.895)	(-0.882)
Board size	?	0.004	0.003	0.003
		(0.163)	(0.152)	(0.154)
DACC	+	-0.294	-0.296	-0.290
		(-1.640)	(-1.643)	(-1.613)
Delaware	+	0.200**	0.202**	0.200**
		(2.283)	(2.307)	(2.290)
EarnVol	+	1.613	1.637	1.638
		(1.601)	(1.627)	(1.626)
Loss	+	0.306***	-0.473	0.308***
		(3.880)	(-0.970)	(3.904)
M&A	?	0.005	0.005	0.004
		(0.083)	(0.078)	(0.061)
MTB	+	-0.122***	-0.123***	-0.124***
		(-3.313)	(-3.327)	(-3.345)
NBSeg	?	0.100	0.103	0.100
		(1.094)	(1.120)	(1.093)
NegEC	+	0.012	0.013	-0.403
		(0.336)	(0.355)	(-1.429)
NGSeg	?	0.118	0.122	0.118
		(1.340)	(1.385)	(1.336)
REM	+	8.634***	8.648***	8.603***
		(4.461)	(4.462)	(4.445)
RetVol	+	2.999***	3.011***	2.987***
		(4.791)	(4.814)	(4.773)
SEO	?	0.168*	0.164	0.167*
		(1.657)	(1.620)	(1.649)
Size	?	0.225***	0.225***	0.225***
		(5.643)	(5.667)	(5.657)
SPI	?	-0.067	-0.060	-0.073
		(-0.109)	(-0.097)	(-0.120)
Constant		15.575***	15.690***	15.773***
		(32.018)	(31.363)	(30.374)
Year & industry fixed effects		Yes	Yes	Yes
Observations		6,395	6,395	6,395
Adjusted R^2		0.245	0.245	0.245

This table shows the robustness check of **H1** and **H2**, where the dependent variable is the Fog index of the MD&A and the independent variables of interest are CEO duality and INDEP, where INDEP is defined as the proportion of independent directors. Column (1) shows the regression results for **H1**, and column (2) and (3) show the regression results of **H2**, where in column (2) bad news is defined as a loss-making firm-year and in column (3) bad news is defined as a firm-year with negative earnings change. Predicted signs are derived from the predicted signs by Li (2008) and Lo et al. (2017), however, when predicted signs differ from empirical results the predicted sign is listed as "?". All continuous variables are winsorized at 1% and 99% of the distribution and detailed variable definitions can be found in **Appendix A**. Standard errors are clustered at firm level. T-statistics are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level (two-tailed test).

16.Appendix I

Table 16

The effect of board independence on the abnormal Fog of the MD&A.

Independent variable	Predicted sign	
CEO duality	+	-0.016
		(-0.234)
INDEP	−	0.295
		(0.810)
Age	?	-0.004
		(-1.191)
BigN	−	-0.133
		(-1.192)
Board size	?	0.021
		(1.036)
DACC	+	-0.032
		(-0.181)
Delaware	+	0.177**
		(2.073)
EarnVol	+	-0.406
		(-0.405)
Loss	+	0.053
		(0.698)
MTB	+	-0.016
		(-0.477)
NegEC	+	-0.004
		(-0.095)
REM	+	2.158
		(1.101)
RetVol	+	1.918***
		(2.883)
SPI	?	0.020
		(0.034)
Constant		-0.546
		(-1.282)
Year & industry fixed effects		Yes
Observations		6,194
Adjusted R^2		-0.001

This table shows the robustness check for **H3**, where the abnormal Fog is the dependent variable and the independent variables of interest are CEO duality and the proportion of independent directors. Predicted signs are derived from the predicted signs by Li (2008) and Lo et al. (2017), however, when predicted signs differ from empirical results the predicted sign is listed as "?". All continuous variables are winsorized at 1% and 99% of the distribution and detailed variable definitions can be found in **Appendix A**. Standard errors are clustered at firm level. T-statistics are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level (two-tailed test).

17. Appendix J

Table 17

The effect of board independence on the abnormal Fog using standard errors clustered at industry level.

Independent variable	Predicted sign	
CEO duality	+	**-0.015**
		(-0.356)
INDEP	−	**0.192**
		(0.750)
Age	?	-0.004
		(-1.032)
BigN	−	-0.137
		(-1.487)
Board size	?	0.020
		(1.284)
DACC	+	-0.032
		(-0.331)
Delaware	+	0.177**
		(2.373)
EarnVol	+	-0.406
		(-0.412)
Loss	+	0.052
		(0.690)
MTB	+	-0.015
		(-0.354)
NegEC	+	-0.003
		(-0.077)
REM	+	2.163
		(1.469)
RetVol	+	1.907***
		(2.845)
SPI	?	0.030
		(0.044)
Constant		-0.421
		(-1.224)
Year & industry fixed effects		Yes
Observations		6,194
Adjusted R^2		-0.001

This table shows the robustness check for **H3**, where the abnormal Fog index is the dependent variable and standard errors are clustered at industry level (two-digit SIC). Predicted signs are derived from the predicted signs by Li (2008) and Lo et al. (2017), however, when predicted signs differ from empirical results the predicted sign is listed as "?". All continuous variables are winsorized at 1% and 99% of the distribution and detailed variable definitions can be found in **Appendix A**. T-statistics are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level (two-tailed test).