Linguistic Complexity and the Post-Earnings Announcement Drift

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Abstract

In this paper, I investigate the relationship between the verbal complexity of annual earnings announcement conference calls and the Post-Earnings Announcement Drift. I determine the degree of linguistic complexity in conference calls of large public companies in the S&P 500 using the Fog Index from computational linguistics. Consistent with my hypotheses, I find that both the timeliness and magnitude of the market's reaction to qualitative information in annual conference calls exhibit evidence of a price drift. This research may be relevant to analysts, investors, managers, and regulators that wish to standardize how information within earnings conference calls is presented.

Keywords: linguistic complexity – conference calls – information asymmetry – disclosures

1 INTRODUCTION

This study seeks to explore the Post-Earnings Announcement Drift (PEAD) and the managerial factors that influence investors' responses. Specifically, I attempt to gain a better understanding of how the complexity of managements' statements during the annual earnings conference call influence the PEAD. The PEAD is defined as the cumulative "abnormal" return either above or below the expected return of firms for up to 60 days following an earnings announcement[1,2]. It is one of the most perplexing anomalies in accounting research and has been referred to as the "granddaddy of all underreaction events"[3]. The PEAD is a puzzling and persistent topic in accounting literature in part because it has continued for nearly five decades, and new drivers are regularly identified[4].

To frame the motivations for this research, I invoke *information asymmetry* within accounting research and why disclosures, in this case verbal disclosures, are a significant source of information. In business, information asymmetry occurs when management possesses material information that external users of the financial statements are not privy to therefore creating a "gap" in knowledge[5]. For example, because a manager is involved in the day to day firm operations, they will undoubtably have a better estimate of true firm performance than any financial statement can provide, but the underlying intent of the accounting information is to reduce this "gap" between parties. Therefore, I rely on economic theory that suggests informative disclosures reduce the level of information asymmetry between investors and managers resulting in a lower PEAD[6].

Across all disciplines, information undoubtably influences decision-making. In accounting research, information is considered to be informative if it can change the beliefs of the receiving audience. In a theoretical world with perfect conditions of a fully efficient market, the timing, amount, and uncertainty of a firm's future cash flows are known by all market participants. Therefore, the expected earnings of the firm would be equal to the actual earnings of the firm. There would be no drifting of prices nor earnings surprises; unfortunately, real-world conditions exhibit significant uncertainty to describe anomalous and inefficient pricing movements. Underpinning the PEAD is the concept that new information changes the beliefs of the market, such as external users of the financial statements like analysts and investors with delay.

Prior accounting literature is replete with driving quantitative factors of the PEAD, but only recently has the influence of *qualitative* information been explored. There is extensive literature describing that investors possess a limited attention to process complex quantitative information[7]. Thus, if investors, as an aggregate, are slow to process complex information due to time necessary to collect, interpret, untangle, and efficiently trade on their information set, it is logical that stock pricing incorporates information with some delay. I argue that some drifting of asset pricing behaves

similarly with *qualitative* information. This assertion coincides with many pioneering studies, including Das and Chen[8], Tetlock[9], and Li[10], which find that managerial word selection and the language used by media to report on firms have been shown to be correlated with future stock returns and earnings[11]. I predict that the timeliness and magnitude of the investor's reaction is correlated with the level of complexity in the earnings conference call.

An annual conference call is composed of two sections, a prepared management discussion of results followed by a question and answer session between management and institutional investors. I use both managements' prepared remarks and the question and answer portion of the annual earnings conference call as the primary source of management's communication. By reviewing both sections of the conference call, I may holistically view management's communication. Ideally, the question and answer section of a conference call organically informs external users of financial statements to reduce information asymmetry. Finally, the latter section of the conference call better reflects intentional managerial actions because the language used is live and reactive to investor questioning[6].

Resulting from my statistical analysis, I find there to be a positive correlation between linguistic complexity exhibited by management on conference calls and the related magnitude of the PEAD and timeliness of information appropriation. At the time of writing, no other research has analyzed the complexity of verbal disclosures in driving the extent of the PEAD. This research may be relevant to analysts, investors, managers, and regulators that wish to standardize how information within earnings conference calls is presented. Furthermore, this research is important to investors because management's verbal communication contains important textual information indicative of future firm performance beyond the financial statements proper. This can help to influence the asymmetric information gap between investors and managers.

Despite cumbersome effort to offset the inherent limitations of any empirical study, this novice analyst notes significant constraints relating primarily to the robustness of statistical analysis. This empirical study is limited to a small yet, still statistically relevant, sample size sourced from manually coded measures of disclosure quality. Future studies may consider leveraging linguistic software to create a stronger statistical analysis. Another major limitation concerns the vast array of information and complexity of market forces that add noise to the information process, making it difficult for researchers to isolate drivers of PEAD. Other determinants, such as quantitative information present in a conference call and during an earnings presentation, general market conditions, historical firm performance, and management characteristics, should be acknowledged because they are present in investors' assessments of firm value and hence influence the PEAD. Finally, due to the nature of the sample, the results may exhibit some self-selection bias because electing to host a conference call is a voluntary choice. Therefore, regardless of any other firm specific factor, this sample is inherently limited to those companies that have chosen to participate in a conference call.

2 HYPOTHESES DEVELOPMENT

As information becomes more complex, there is an increased time to fully process and understand a situation. For an individual, these inferences are based on Information Processing theory rooted in human psychology[12]. For example, if we were driving in a new area attempting to read a road sign, our ability to come to a conclusion as to where we were going would be influenced by the complexity of the situation, such as the color of the sign, the language of the sign, the time of day, the distance from the sign, etc. That is, as the plethora of stimuli surrounding the sign becomes more complex, it takes us longer to understand the message. Despite the number of people in the vehicle, there will still be a slight delay but, processing time will be reduced as the number of people looking at the sign increases.

I apply processing theories to the accounting research setting to examine whether the level of complexity of the conference call drives the timeliness and magnitude of the PEAD. I predict that as disclosures become more (less) informative, there is a reduction (an increase) in the level of information asymmetry between managers and investors as demonstrated by lower (higher) PEAD. My proxy for informativeness is the degree of linguistic complexity displayed by management. These dynamics may be broken down further into two specific hypotheses regarding the impact of complexity on the timeliness and magnitude of the PEAD, respectively.

First, I hypothesize that less information asymmetry between managers and investors will solicit a smaller magnitude, in terms of absolute percentage, of the abnormal return of the related stock price over the expected return. The magnitude can be viewed as being a function of the timeliness of information appropriation as well as the informativeness of the accounting information. Therefore, as market disclosures become more informative, the absolute range of the abnormal return will diminish; there will inherently be a reaction to the earnings announcement and less abnormal drifting of price because investors may arrive at a consensus sooner.

H_1: The level of linguistic complexity exhibited by management on the conference call is positively associated with the magnitude the PEAD.

Second, I hypothesize that as disclosures become

more informative, the time delay of information appropriation will be reduced. Therefore, more informative disclosures will still produce a drift due to the inherent processing time needed by investors but, such drift will be shorter in time as compared to obfuscatory[1] comparison disclosures of other firms. As market disclosures become more informative (i.e., less complex), the aggregate investor pool may arrive at a consensus price in a shorter amount of time because there is less extraneous information to process. This is analogous to the prior example of reading road signs.

H_2: The level of linguistic complexity exhibited by management on the conference call is positively associated with the time delay of information appropriation.

3 RESEARCH DESIGN AND SAMPLE

3.1 Measuring PEAD

The PEAD is measured as the cumulative abnormal returns from the event day (conference call) to 60 days thereafter. Abnormal returns are calculated based on the three-factor capital asset pricing model[2] of Fama and French[13].

3.2 Measuring Complexity

The degree of complexity embedded in managerial statements is defined as *linguistic complexity* which refers to all aspects of a language that make communication easier or simpler when speaking[14]. To quantify this complexity, I utilize the Gunning's *Fog* Index of Readability Formula to value the comprehensibility demonstrated on each conference call. The *Fog* index has been used in many disciplines and only recently finding an application in business research. Developed in 1952 by Robert Gunning, this index comes from computational linguistics literature and combines the number of words per sentence and the number of syllables per word to create a measure of readability. Therefore, assuming that all else is equal, the more syllables per word or more words per sentence make a qualitative information set harder for the audience to comprehend[10]. The *Fog* index is a function of two variables:

Fog Index = 0.4 (*average number of words + percentage of complex words*)

Moreover, the *Fog* index estimates the number of years of education needed to understand the information on the first reading. Thus, the higher the value, the more complex the text thus in theory requiring more effort to read it. A *Fog* score of 8-10 is considered elementary, 10-12 is ideal, 13-18 is difficult, and any score above 18 is effectively incomprehensible[10]. I capture the *Fog* score separately for both the formal presentation and management's answers to analyst inquires as reflected as the variables of *Fog(Present)* and *Fog(Response)*, respectively, in the analysis section to follow.

3.3 Regression Analysis

In order to examine the relationship between linguistic complexity and the PEAD and test my hypotheses, I estimate multivariate regressions[3] to measure an association between the *Fog* complexity metrics and the abnormal return of the firm.

3.4 Sample and Descriptive Statistics

The sample period for my study includes years 2015-2018, resulting in data on 200 firm-years among the 50 companies in my sample. I hand-collect conference calls transcripts sourced from a variety of sources including the respective firm's investor relations page or proxy websites containing firm-specific financial information particularly, seekingalpha.com. Stock returns and other accounting items are sourced from Center for Research in Security Prices CRSP) and Compustat data. A disadvantage of such a small sample size stems from the difficulty in drawing clear and generalizable inferences due to lack of statistical power. The cost to manually source and analyze such data for the purposes of this research has ultimately led to this concession. As a result of the relatively small sample size used in this research, both the Fog index and the number of words measurement are inputted manually to a computer program sourced from a website dedicated to the measurements[15].

Before performing regression analysis, it is important to isolate pertinent variables that control for key differences in firm characteristics.Table 1 presents the variables used in the multivariate regression of this study. As a result of CRSP and Compustat data limitations, observations for which data on all variables are available reduces sample to 150 firm-year observations. *ABRET* is the key independent variable, described as the difference between the expected Capital Asset Pricing Model (CAPM) return of the firm and the actual firm return. *Net Income* is an important variable to control for firm performance in the period of the conference call. *R&D* expense is important to consider because it is a proxy for information asymmetry between managers and external users of the financial statements. Finally,

[1] *Obfuscation* in accounting research refers to the intentional attempts of management to confuse users of the financial statements.

[2] The three-factor capital asset pricing model (CAPM) calculates the expected returns of a firm as being equal to the risk-free return (typically the yield on 10-Year US Treasury Bonds) plus a risk premium, which is based on the beta (firm specific risk) of that security.

[3] Regression analysis is a set of statistical processes to estimate the relationship between a dependent variable and one or more independent variables.

Table 1 Descriptive Statistics of Pertinent Variables. This table presents the descriptive statistics for the variable used in the following regression analysis, with the abnormal return (*ABRET*) as the independent variable. The dependent variables are the measures of linguistic complexity (*Fog(Response)*, *Fog(Presentation)*) and the variables used to control the primary other determinants of abnormal return as annual performance, information asymmetry, and size, as *Net Income*, Research and Development (*R&D*), and the logarithm of total firm assets (*Log(Total Assets)*), respectively.

Variable	N	Mean	Std. Dev.	Sum	Minimum	Maximum
ABRET	150	0.0042	0.0355	0.6365	-0.1031	0.1503
Fog(Response)	150	11.5308	1.4042	1730.0000	8.3740	15.9700
Fog(Presentation)	150	13.1852	1.2719	1978.0000	9.1840	15.8000
Net Income	150	0.0975	0.0721	14.6171	-0.0367	0.4377
R&D	150	0.0506	0.0600	7.5933	0.0000	0.2915
Log(Total Assets)	150	10.9276	0.9956	1639.0000	8.3109	13.1076

Table 2 Pearson Correlation Coefficients, N=150. This table shows the Pearson correlation coefficients of abnormal return (*ABRET*) with the measures of linguistic complexity (*Fog(Response)* and *Fog(Presentation)* and the variables used to control the primary other determinants of abnormal return as annual performance, information asymmetry, and size, as *Net Income*, Research and Development (R&D), and the logarithm of total firm assets (*Log(Total Assets)*), respectively. ***, **, and * denote statistical significance at the .01, .05, and .10 rounded levels, respectively.

	Fog (Response)	Fog (Presentation)	Net Income	R&D	Log (Total Assets)
ABRET	0.16492***	-0.00428	0.05575**	0.01561*	-0.05636
Fog(Response)		0.18320***	0.00691	0.11431***	-0.18379
Fog(Presentation)			0.05982**	-0.00332	0.11819***
Net Income				0.05422**	-0.34287
R&D					-0.28173

although accounting for the *Total Assets* of these firms adjusts for size, taking the logarithm further controls for potential skewness in firm size in the sample population.

Table 2 presents the Pearson Correlation Matrix of the pertinent variables identified in Table 1. I note a minor correlation between *Net Income* and *ABRET* of .05575 and a significant correlation coefficient between the abnormal return (*ABRET*) and the *Fog(Response)* of .16492. Before any substantial analysis, this correlation initially indicates that there may be a statistically significant relationship between the abnormal return and the complexity of management's responses. Furthermore, this is a strong correlation in comparison to the other variables that are either negatively or insignificantly correlated to the abnormal return. Additionally, there is a strong correlation between the *Fog(Presentation)* and the Fog(Response) of .1832. This is an understandable relationship because as a firm's operations increased in complexity, so too would the language needed to transmit the necessary information to investors in both formal presentation and responses to questions.

4 RESULTS

As a baseline test to identify a market reaction to conference call data, I graphed the cumulative abnormal returns, on the x-axis, against a number of days before and after the call, on the y-axis. This graph represents the PEAD, and the data is similar to graphical representations in seminal papers on earnings drifts[2].

Abnormal returns are defined in this study as the amount above or below the expected Capital Asset Pricing Model (CAPM) market return. The *Day Relative to Event* is the number of days before and after a call, from 5 days before to 60 days after.

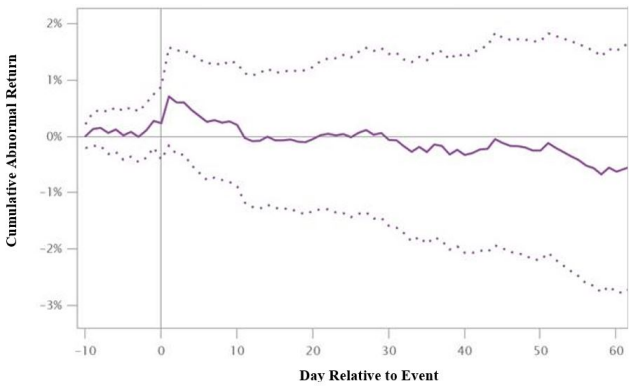

Figure 1. Cumulative Abnormal Return. Figure 1 presents the initial cumulative abnormal compared to the expected return, expected as a result of the Capital Asset Pricing Model (CAPM)[4]. The solid line represents the average abnormal return while the dashed lines represent the minimum and maximum abnormal returns.

Table 3 Preliminary Regression Outputs. Table 3 presents the regression outputs of a simple relationship between the measures of linguistic complexity *Fog(Response)* and *Fog(Presentation)* and abnormal return (*ABRET*) before controlling for specific firm factors. R^2 and Adjusted R^2 present how well the regression measures the relationship between the sample data and the variables isolated. ***, **, and * denote statistical significance at the .01, .05, and .10 rounded levels (two-tail), respectively.

					Heteroscedasticity Consistent		
Variable	*Coefficients*	*Standard Error*	t-Stat	*P-value*	*Standard Error*	*t-Stat*	*P-Value*
Intercept	-0.0326	0.0353	-0.92	0.3574	0.0332	-1.00	0.328
Fog(Response)	0.0043**	0.0021	2.07	0.0399	0.0018	2.45	0.016
Fog(Present)	-0.0010	0.0023	-0.43	0.6667	0.0021	-0.50	0.631
			R^2	0.0284			
			Adjusted R^2	0.0152			
			Observations	150			

Table 4 Multivariate Regression Outputs. Table 4 presents the outputs of a multivariate regression between the abnormal return (*ABRET*) and the measures of linguistic complexity *Fog(Response)* and *Fog(Presentation)*, and the variables used to control the primary other determinants of abnormal return as annual performance, information asymmetry, and size, as *Net Income*, Research and Development (*R&D*), and the logarithm of total firm assets (*Log(Total Assets)*), respectively. R^2 and Adjusted R^2 present how well the regression measures the relationship between the sample data and the variables isolated. ***, **, and * denote statistical significance at the .01, .05, and .10 rounded levels (two-tail), respectively.

					Heteroscedasticity Consistent		
Variable	*Coefficients*	*Standard Error*	t-Stat	*P-value*	*Standard Error*	*t-Stat*	*P-Value*
Intercept	-0.0328	0.0521	-0.63	0.5296	0.05447	-0.6	0.548
Fog(Response)	0.0043**	0.0022	2.01	0.0468	0.00184	2.36	0.020
Fog(Present)	-0.0011	0.0024	-0.46	0.6492	0.00207	-0.52	0.601
Net Income	0.0277	0.0434	0.64	0.5249	0.04242	0.65	0.516
R&D	-0.0048	0.0507	-0.09	0.9247	0.06483	-0.07	0.941
Log(Total Assets)	-0.0001	0.0034	-0.03	0.9731	0.00390	-0.03	0.977
			R^2	0.0317			
			Adjusted R^2	-0.0019			
			Observations	150			

If there is no abnormal return, then I infer that the market is unsurprised by the information held within these calls. My findings suggest the opposite, there is a market reaction, represented by a jump in abnormal return on the day following the conference call date, Day 1. A jump on the following day can be explained as most conference calls occur after market close on day zero, resulting in the market reaction to take place on Day 1.

Before proceeding with more substantial estimations of relationships between the independent variable of Abnormal Return (*ABRET*) and the identified variables discussed in the prior section, an understanding of the isolated relationship between *ABRET* and linguistic complexity is helpful. I am able to identify preliminary relationships and Table 3 presents the initial regression outputs. For this study, a variable is considered to be statistically significant when its probability value, (*p value*) is less than .1, representing that the probability of a variable is sufficient to reject the null hypothesis. My findings suggest that before controlling for any external firm factors, the complexity of the response section is increasing (i.e. positively related to) and statistically significant in describing the fluctuations in *ABRET* as indicated by a *p value* of .0399. I find the level of complexity in the presentation section to be insignificant.

Table 3 provides limited evidence of the *Fog* measures ability to explain the variations in *ABRET* because the presented regression fails to account for other determinants that may influence the abnormal return such as the firm performance over that period, the level of information asymmetry between investors and managers, or the relative size of the firm. In attempts to control such factors, Table 4 presents extended findings:

After controlling for significant other determinants of *ABRET*, the initial results found in Table 4 uphold statistical relevance. Despite the increase in *p value* of *Fog(Response)*, the linguistic complexity of management's responses maintain statistical significance in describing abnormal returns. I find neither the complexity

Table 5 Market Timeliness of Information Appropriation. Table 5 presents the outputs of the event day controlled multivariate regression. The outputs compare the relationship between abnormal return (*ABRET*) on successive each day proceeding the conference call date and the measures of linguistic complexity *Fog(Response)* and *Fog(Presentation)*, firm performance, information asymmetry, and size, as *Net Income*, Research and Development (*R&D*), and the logarithm of total firm assets (*Log(Total Assets)*), respectively. ***, **, and * denote statistical significance at the .01, .05, and .10 rounded levels (two-tail), respectively.

Event Day	1	2	3
Intercept	0.86302	0.14547	0.03175
Fog(Response)	0.09979*	0.86361	0.98181
Fog(Presentation)	0.92418	0.16100	0.12635
Net Income	0.92823	0.51116	0.08511*
R&D	0.59693	0.23010	0.09282*
Log(Total Assets)	0.24074	0.47911	0.12344
R^2	0.03333	0.03333	0.06250
Adjusted R^2	0.00111	0.00110	0.03125
Observations	150	150	150

of the presentation nor any other determining factors to be remotely significant, as indicated by large *p values*. In the conference call setting, an investor focus on managerial response is understandable because priority is placed on the perspectives of management rather than the scripted presentation. The scripted section merely recounts the respective period's performance, typically publicized to the market before the call. In contrast, managerial responses provide specific information in real time to pointed questions from analysts; therefore, such answers are more significant to investors seeking new information or a different perspective from insiders.

To determine the extent to which either the regression outputs of Table 3 or 4 explain the behavior of *ABRET* in the following 60 trading days, I investigate the R^2 and Adjusted R^2 values. These values measure the model's ability to "fit" the datasets and are referred as a percentage of variation in the data. For instance, in Table 3, I find a R^2 value of .0284 and adjusted R^2 of .0152 indicating that only 2.84 and 1.52 percent of the variation in the dataset is explained by the complexity. In Table 4, the regression, R^2 increases to 3.17 percent, but the Adjusted R^2 turns negatives effectively rendering it as zero (indicating the model may be a poor fit). For comparison, it is important to note that publishable studies enjoy only a marginal increase in R^2 ranging from 0.00 to 0.29[10].

Slight values for R^2, adjusted or not, initially evokes pessimism in a researcher, but through further investigation creates optimism, the shift in mindset stems from understanding the environment of abnormalities. My independent variable is just that, the cumulative abnormal return of an equity security over 60 days, and to find any relation at all is significant. This is because abnormalities in security movements are multifactorial, and are difficult to control, given the limits in research design of this study. For instance, at the time of the earnings conference call, there is a plethora of signals moving through the capital markets such as an increased level of uncertainty from investors, news articles from media outlets, and all quantitative information. With enough variables in a regression, one would observe higher values of R^2 of the *ABRET* model, but because of the focused nature of this study, it is logical to only describe between 1 and 3% of the abnormal return. Nevertheless, the findings from Table 4 suggest the confirmation of H_1, that the magnitude of the PEAD is associated with the relative complexity of managerial conference call language.

The results in Table 5 suggest the market reaction to the level of linguistic conference call complexity is positively associated with the time delay of the PEAD. Specifically, managerial responses, as represented by *Fog(Response)*, are statistically significant within a 10 percent probability of rejecting the null hypothesis. *Fog(Response)* presents a *p value* of .09979, supporting my second hypothesis (H_2) that there is a relationship between linguistic complexity and the time delay of the PEAD. Although these results are encouraging, the sample evidence fails to support an extended PEAD, that is a drift beyond one day, suggesting that external market participants require only a slight time delay to fully process the increased level of complexity. Additionally, conference calls are typically held following the market close, thus an increased abnormal return is expected because the majority of trades occur upon open the following day.

5 CONCLUDING REMARKS

Despite limitations of this research as they relate to the robustness of statistical analysis and usage of the *Fog* index, the results derived are novel and prompt future

research. Such future studies should consider utilizing multiple complexity measures, that is to say not simply the *Fog* index, to offset these potential validity concerns, doing so will also increase the generalizability of the results within the conference call setting. I encourage future work to investigate other aspects of verbal and textual complexity from different sources as driving forces behind the PEAD. Regardless, these findings suggest that managers should continually exercise caution when disseminating information to analysts.

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7 EDITOR'S NOTES

This article was peer reviewed.

REFERENCES

[1] Ball, R. & Brown, P. An Empirical Evaluation of Accounting Income Numbers. *Journal of Accounting Research* (1968).

[2] Foster, G., Olsen, C. & Shevlin, T. Earnings Releases, Anomalies, and the Behavior of Security Returns. *Source: The Accounting Review* (1984).

[3] Fama, E. F. Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics* (1998).

[4] Choi, J., Thompson, L. & Williams, J. Asymmetric Learning from Prices and Post-Earnings-Announcement Drift. *Contemporary Accounting Research* (2019).

[5] Healy, P. M. & Palepu, K. G. Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature. *Journal of Accounting and Economics* (2001).

[6] Bushee, B. J., Gow, I. D. & Taylor, D. J. Linguistic Complexity in Firm Disclosures: Obfuscation or Information? *Journal of Accounting Research* (2018).

[7] Cohen, L. & Lou, D. Complicated firms. *Journal of Financial Economics* (2012).

[8] Das, S. R. & Chen, M. Y. Yahoo! for amazon: Sentiment extraction from small talk on the Web. *Management Science* (2007).

[9] Tetlock, P. C. Giving content to investor sentiment: The role of media in the stock market. *Journal of Finance* (2007).

[10] Li, F. Annual report readability, current earnings, and earnings persistence. *Journal of Accounting and Economics* (2008).

[11] Loughran, T. & Mcdonald, B. Textual Analysis in Accounting and Finance: A Survey. *Journal of Accounting Research* (2016).

[12] Miller, G. A. The magical number seven, plus or minus two: some limits on our capacity for processing information. *Psychological Review* (1956).

[13] Fama, E. F. & French, K. R. The Cross-Section of Expected Stock Returns. *The Journal of Finance* (1992).

[14] Pallotti, G. A simple view of linguistic complexity (2015).

[15] Bond, S. Gunning Fog Index URL `http://gunning-fog-index.com/`.