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# The Fog Index in Accounting Research: Contributions and Challenges

EKAETE EFRETUEI<sup>a\*</sup> AND KHALED HUSSAINEY<sup>b</sup>

## ABSTRACT

**Purpose:** The objective of this paper is to review the use of the fog index in accounting research.

**Design/methodology/approach:** This paper uses a systematic literature review (SLR) methodology with a sample of 126 accounting research articles. The review applies the theoretical framework of disclosure's stewardship, valuation, and accountability roles to identify the contributions and challenges of using the fog index in accounting research.

**Findings:** This paper shows that the primary contribution of the fog index to accounting research relates to the disclosure obfuscation hypothesis (e.g. whether management obfuscates narratives associated with earnings). It also finds that the challenge in using the fog index is in disentangling its measure of firm environmental complexity from narrative obfuscation. Regarding disclosure utility, there is limited evidence on the differential effects of complexity on investor-types and whether the fog index findings are associated with narrative obfuscation or firm environmental complexity is driven by investor types.

**Research/Practical Implications:** We develop a research database of fog index studies categorised based on contributions to disclosure obfuscation or disclosure utility. Highlighting contributions to the stewardship, valuation and accountability roles of disclosures, which researchers can use to develop future studies.

**Originality:** This paper contributes to accounting literature by offering the first comprehensive review on the use of the fog index in accounting research. It offers researchers a consolidated review of the study of linguistic complexity of accounting information and disclosure functions using a theoretical framework that can inform regulators, policymakers and future researchers in designing future research/policy.

**Keywords:** Disclosure Readability, Fog Index, Accounting Narratives, Corporate Reports

**JEL Classification:** M40, M41, M49.

**Data Availability:** Data are available from public sources cited in the text

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## 1. Introduction

Readability formulas count textual characteristics to score a document's reading difficulty (Brennan et al., 2009). Regarding accounting reports, readability incorporates the ease of accessibility of narrative disclosure (Efretuei, 2013) and the effective communication of value-relevant information (Loughran & McDonald, 2014). Extant accounting research applies readability formulas to measure linguistic attributes of disclosure, such as document length, word, and sentence length (Courtis, 1998, 2004). Readability has been used as different theoretical constructs of accounting information over time. This includes understandability (Smith & Taffler, 1992), complexity (Efretuei, 2013), accounting quality (Biddle et al., 2009), reporting quality (Glendening et al., 2019), transparency (Brochet et al., 2016), effective communication (Loughran & McDonald, 2014), and informativeness (Ettredge et al., 2018). Blankespoor et al. (2020) find that these terms are used to measure both broader complexity and linguistic complexity. Studies using readability constructs struggle to isolate linguistic complexity from other sources of complexity. This review explores this debate by identifying proposals relevant to using the fog index.

Fog index determinants studies start with the assumption that management can manage the narratives and thus obfuscate, leading to more difficult-to-read narratives in financial reports (Hooghiemstra et al., 2017; Li, 2008; Lo et al., 2017). Li (2008) reports that difficult-to-read narratives are associated with poor-performing firms, while Hooghiemstra et al. (2017) find that managers also obfuscate remuneration reports to reduce say on pay votes. These studies also find that the inherent characteristics of a firm, such as industry type (Efretuei, 2021) and the applied accounting standards (Lang & Stice-Lawrence, 2015), can make narratives more difficult to read. The consequences studies consider the impact of difficult-to-read narrative reporting on the users of accounting information. These conclude that difficult-to-read reports are associated with stock

price delay (Callen et al., 2013; Kim et al., 2019), firm value (Caglio et al., 2020), and analyst behaviour (Lehavy et al., 2011).

We review these studies by reporting the findings on disclosure obfuscation (determinants of complexity) and disclosure utility (consequences of complexity) using a systematic literature review (SLR) of 126 fog index articles. This review contributes to the interpretation of the theoretical application of readability formulas in accounting research by investigating its contributions and challenges to accounting disclosure's stewardship, valuation, and accountability roles. It discusses the challenge of disentangling the informative and obfuscating components of accounting narratives in applying the fog index, including suggestions for addressing this when developing future research. It offers researchers on this topic a consolidated view of how the study of linguistic complexity of accounting information aids in the understanding of the usefulness of accounting (Drake et al., 2016).

The paper is structured as follows. Section 2 discusses conceptual underpinnings. Section 3 reports the methodology. Section 4 discusses the insights from the literature. Section 5 identifies broader challenges and suggestions for future research. Section 6 concludes.

## **2. Conceptual Underpinnings**

### **2.1. The Fog Index**

The Fog Index measures readability as a function of (a) the number of words per sentence and (b) the percentage of words identified as “complex”. Complex words consist of three or more syllables (Hemmings et al., 2020; Li, 2008). Based on the principle that all things being equal, longer words and longer sentences make a document more difficult to read (Loughran & McDonald, 2016). The formula for measuring the fog index is:

$$\text{Fog Index} = 0.4 * (\text{Words per Sentence} + \text{Percent Complex Words})$$

We focus on the fog index for three reasons. First, it has been the focus of readability research in accounting (Lang & Stice-Lawrence, 2015). Second, regulators have proposed it for potential use as a measure for assessing the text of report filings (Lundholm et al., 2014). Third, it provides a measure to assess the impact of words on enhancing/mitigating the role of corporate disclosure. Furthermore, the ongoing debate on the most suitable readability formula in the accounting literature tends to use the fog index as the formula for comparisons. For example, Loughran & McDonald (2014) use the fog index to assess readability in reports compared with a new readability measure, ‘file size’. Bonsall et al. (2017) also propose a measure of readability called the ‘Bog index’, which compares to the features of the fog index. The file size measures file properties beyond syntactical textual characteristics (Bonsall et al., 2017), while the Bog index is of limited use in accounting research. Searching Scopus database shows three studies applying the Bog index in the accounting research literature. Other measures of readability used are the Flesch Reading Ease Index (Cassell et al., 2019) and Flesch–Kincaid grade level (Chen & Tseng, 2021). These two measures are based on word, sentence, and syllables estimation, which are of similar characteristics to the fog index.

The fog index has dominated the recent debate on assessing the relevance of readability formulas and accounting narratives, giving us an adequate sample of articles to conduct a SLR. Studies increasingly use this index in accounting research to investigate information or obfuscation (Bushee et al., 2018), earnings obfuscation (Lo et al., 2017), market prices impact (Kim et al., 2019) . Other studies have used it as a measure of accounting quality (Callen et al., 2013; Glendening et al., 2019).

## **2.2. Research Gap**

There are a number of review papers on readability. For example, Jones & Shoemaker, (1994) reviewed readability methodology and measures. Gosselin et al. (2021) report a broad overview of readability research issues using the readability wheel of who, what, how, why and to whom, while Smaili et al. (2022) focus on the top management strategy for managing readability. This review adds to prior review on readability studies (Gosselin et al., 2021; Jones & Shoemaker, 1994; Smaili et al., 2022) by reviewing the theoretical application of a readability measure (the fog index) to the role of disclosures. This review relates readability research to accounting disclosure. By using the role of disclosure theoretical framework to categorise the review findings, it provides a framework for future research using the index to identify readability research contributions to disclosure theory. This also allows it to explore further the isolating effects of linguistic complexity on accounting information (Blankespoor et al., 2020) and its impact on users.

## **2.3. Theoretical Framework**

From figure 1, the concept map, consistent with existing accounting literature, we identify three disclosure roles: stewardship; valuation; accountability (Michelon et al., 2020). To guide our discussions on the proposals from existing studies, we classify these functions into [1] disclosure obfuscation, to contribute to the research gap exploring the challenge of disentangling the information and obfuscating components of disclosure complexity (stewardship role of disclosures), and [2] disclosure utility, to contribute to the research gap on the impact of disclosure complexity on investor types (valuation and accountability role of disclosures). We view disclosure obfuscation from the perspective of the preparers' actions and disclosure utility from

the perspective of impact on users/regulators' actions.

{Insert Figure 1 Here}

Disclosure obfuscation is the use of narrative components of disclosure to deter readers from accessing this information in the reports by either producing excessively long documents or using complex words (Alm El-Din et al., 2021; Li, 2008). Stewardship is providing 'full and transparent' information/reports (Michelon et al., 2020). It includes relying on management to reflect economic phenomenon transparently (Zeff, 2013), and the faithful representation of the use of firm resources for contracting, managerial compensation, and other internal uses (Ball, 2016; Dichev et al., 2012). Using this perspective, this fog index review explores how the attributes of disclosures reflect management disclosure transparency.

Disclosure utility is the effect of complex narrative reporting on the ability of users to use financial reporting information (Hooghiemstra et al., 2017; Lehavy et al., 2011). Valuation is 'decision usefulness criteria' for capital market providers' (Michelon et al., 2020: p. 3; Zimmerman, 2015). Using this perspective, this fog index review explores how the attributes of disclosures informs users' decision-making. Accountability is 'an account of actions for which an organisation is held responsible' (Gray et al., 1997; Michelon et al., 2020). In this study, given the overlap between stewardship and accountability, we view accountability from the regulators' perspective. It is the use of regulation to monitor, manage or control disclosure attributes for the benefit of the information users (Christensen et al., 2017; Christensen, 2010).



### **3. Methodology and Observations**

#### **3.1. Systematic Review Protocol**

This review addresses the question, what are the current proposals relevant to using the fog index and, more widely, readability formulas? To achieve this, it conducts a focused SLR using automated textual analysis. The theme is the ‘fog index’ as used in accounting research. The SLR is designed to manage the synthesising of contradictory evidence and relies on pre-specified criteria to mitigate against bias (Alhossini et al., 2021). Similar to Roberts et al. (2021), we identify papers based on a focus research area, keyword search, and papers in the English language. To obtain fog index articles, we retrieve articles from key accounting journals. We focus on the keyword ‘fog index’ to retrieve articles. We also use the keyword ‘fog’ but find that it introduces noise. Specifically, the search retrieves articles that use the word ‘fog’ more towards the description of written language in the text rather than a reference to the fog readability index.

The search focuses on articles of quality classified as world-leading in originality, significance, and rigour or internationally excellent in originality, significance, and rigour, as per the Academic Journal Guide 2018 published by the Chartered Association of Business Schools (ABS) (Alhossini et al., 2021; Michelon et al., 2020). This allows for an externally agreed quality selection criteria and for the process to be manageable. We retrieve articles in the ABS list by identifying journals labelled ‘ACCOUNT’ under the field column and labelled 4\*, 4, or 3 under the ‘AJG 2018’ column in the ABS journal guide document. The focus being on accounting narratives, the review identifies articles only in accounting journals (labelled ‘ACCOUNT’). The timeline of articles retrieved is from 2008 to 2020, the cut-off year. 2008 is the year of the first large-sample accounting publication using the fog index (Beattie, 2014). The selection of this

timeline also allows the study to focus on recently published fog index studies to contribute to the ongoing debate on the relevance of the fog index rather than replicating the review of studies included in existing reviews (Gosselin et al., 2021; Jones & Shoemaker, 1994). Table 1 panel A reports the systematic literature retrieval process.

{Insert Table 1 Here}

Table 1 panel B reports the articles retrieved by journal name. This search resulted in a total of 126 academic articles. The spread of studies across journals shows that these studies are not limited to an accounting paradigm or location. The list includes journals widely identified as North American studies and journals identified as European. As the readability literature is an emerging area in accounting research, we find that later years appear to have a higher number of publications mentioning the fog index. Figure 2 shows the increasing trend of studies referencing the fog index, indicating the importance of reviewing the use of the index in accounting research. This indicates that this index is increasingly important to make significant contributions to accounting research and thus, necessitates a review of its validity for accounting research studies. Appendix A1 provides further granular details of studies retrieved during the search. It reports the journals used for the search and the articles identified.

{Insert Figure 2 Here}

The studies reviewed are from 14 journals, all are in the accounting field. The journals that publish the highest number of articles are: The Accounting Review (18 articles), Journal of Accounting and Economics (17 articles), and Review of Accounting Studies (17 articles). We find that most studies with the highest number of fog index articles are in the 'North American' Journal.

However, the fog index still appears widespread and is published in journals of different paradigms (Hussain et al., 2020) within accounting research. For example, Accounting, Auditing and Accountability Journal and Accounting, Organisation and Society are considered to be of critical, interpretative paradigm, make up 7.14%, compared to other journals of a positivist approach.

### **3.2.Descriptive Analysis of Fog Index Articles**

Table 2 reports the recurring word themes in ‘fog index’ studies. It is collated by retrieving keywords as reported in the articles and conducting a word analysis.<sup>1</sup> The last column titled ‘link to corporate reporting quality’ is guided by Michelon et al. (2020) three functions of corporate disclosures classification: valuation; stewardship and accountability. The table confirms that the themes in the retrieved articles significantly focus on disclosures. The highest occurring word theme is disclosure and reports. We also observe word themes such as readability and earnings as expected in a fog index article collection. In analysing the provision of information to meet the stewardship and the valuation role of corporate reporting, we categorise word themes relevant to stewardship, such as ‘disclosure’ and ‘reports’ indicating information provision. Words such as ‘analysts’ and ‘market’ are categorised under valuation indicating decision usefulness. We categorise one-word theme ‘regulation’ under accountability. For this study, we view accountability as studies observing the role of stakeholders who hold the firms accountable such as regulators. In Appendix A2, we provide a breakdown of the data collected from 107 out of 126 articles, which use the fog index: using a ‘fog’ keyword in context search within each article, we develop a research database of fog index studies categorised based on contributions to disclosure obfuscation or disclosure utility in line with the theoretical framework.

{Insert Table 2 Here}

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<sup>1</sup> Uses a bag of words approach to report keyword frequencies as shown in table 2.

## **4. Insights from Existing Studies**

### **4.1. Disclosure Obfuscation – Contributions to the Stewardship Role of Disclosure**

#### *Historical Trend of Obfuscation Studies*

The obfuscation hypothesis was first defined and applied to demonstrate foggier reports are associated with poor earnings (Li, 2008). However, Bloomfield (2008) argues that bad news could be more difficult to describe. This implied the open research question of whether foggier disclosures imply management disclosure obfuscation. Early findings consistent with the obfuscation hypotheses include: Biddle et al. (2009) using the fog index as a measure of financial reporting quality show a positive association between financial reporting quality and investment for firms that over-invest.; Li (2010) finds lower fog is associated with positive disclosures.

In 2012 - 2013, while disclosure obfuscation studies continued, we find that different settings and theoretical applications of the fog index are explored. Laksmana et al. (2012) find that less readable compensation discussion and analysis disclosures are associated with high CEO pay, and this executive compensation disclosure improves under oversight. Callen et al. (2013) use the fog index as an alternative measure of accounting quality and find that firms with a high fog score have significantly higher stock price delay. Kravet & Muslu, (2013) observe a positive relationship between return volatility and change in the fog index. Kim et al. (2013) use the fog index to measure financial reporting transparency. Arora et al. (2014) find a positive correlation between the fog index and asset reliability, which captures the extent of total assets with concerns about reliability measurement.

### Mixed Evidence on Obfuscation

Studies also evidence informative disclosures rather than obfuscation: Merkley (2014) finds that management adjusts research and development disclosures to provide relevant information around earnings rather than to obfuscate but finds evidence of obfuscation behaviour for earnings-related narratives. Kubick et al. (2020) do not find evidence of opportunistic actions in the readability of disclosures. They find more readable tax footnotes following clawback adoption. However, studies still evidence obfuscation: Brochet et al. (2016) find firms that emphasise short term have less readable narratives. Hasan (2018) finds that managerial ability plays a role in the readability of disclosure. We also see how reporting complexity can indicate opportunistic actions realising disclosure information from managers (Arif et al., 2019; Hooghiemstra et al., 2017).

### Accepting the Obfuscation Theory

It became known in the accounting literature that complex disclosures obfuscate or have a negative effect on the information environment (Guay et al., 2016). Thus, studies using the fog index began to question the determinants/interactions of this observed obfuscation of disclosure such as the role of time trends (Dyer et al., 2016), remuneration obfuscation (Hooghiemstra et al., 2017), while some still asked whether obfuscation is observed, for example Guay et al. (2016) observe that managers increase voluntary disclosures to guide through complex disclosures. Loughran & McDonald (2016) note that it shares the problem that plagues accounting quality measures of separating the document from the business because the fog index seems correlated with underlying business attributes but is difficult to measure or interpret correctly. They propose focusing on the concept of information complexity rather than readability.

Lo et al. (2017) conduct a test of the readability of disclosure and earnings management (EM) using earnings per share (EPS). They use the change in EPS as a simple measure to identify firms that meet or beat their earnings benchmarks as firms that use the opportunities available to manage earnings. The study differentiates between information and obfuscation by using the fraud triangle framework and finds that EM is more likely to occur when management attitude, as displayed in the complexity of disclosure, relates to existing incentives for earnings management and the opportunity to take advantage of these incentives.

### Obfuscation Challenges

The challenge with these studies is capturing information based on additional disclosures instead of complexity. Kubick et al. (2020) attempt an investigation by interpreting the results of the length of disclosure and fog index. This demonstrates additional disclosure versus complexity, given they moved in opposite directions. However, it was still inconclusive concerning differentiating informative (firm) and obfuscating complexity, given that the fog index measures word count based on sentence length, still indicating additional disclosures. Efratuei et al. (2021) also attempt this by categorising the word complexity fog component into information and obfuscation. The fog index readability literature will benefit from disentangling the information and obfuscating components of disclosure complexity in the annual report setting. Lo et al. (2017) provide two reasons why complex disclosure can be expected to be associated with small earnings changes. First, Management Discussion and Analysis (MD&A) section of reports is more likely to focus on reported earnings rather than underlying performance. Second, having managed reported earnings, management is more likely to increase the complexity of disclosures to reduce the depth of investor analysis to ensure that earnings management is not easily detected, and deceptive communication is linguistically more complex. In sum, Lo et al. (2017) show that firms that meet

or beat their earnings forecasts have higher fog index scores (i.e. their reports are more difficult to read). However, Lang & Stice-Lawrence (2015) indicate that fog index is higher in disclosure literature of more complex topics such as financial instruments.

#### **4.2. Disclosure Utility – Contributions to the Valuation Role of Disclosure**

The discussion around decision usefulness and the fog index focuses on disclosure utility for valuation, various investor types and regulators. These valuation studies have demonstrated stronger investor reactions when reports are more complex (Twedt & Rees, 2012), decreased stock returns associated with foggy European Council Communications around summit dates (Wisniewski & Moro, 2014), and lower credit ratings for disclosures that are less clear (Bonsall & Miller, 2017). Twedt & Rees (2012) note that investors are viewing report complexity as more detailed information rather than obfuscation. However, these may vary with investor types.

##### *Professional Investors*

Analysts are also affected by less readable disclosures, as evidenced by the greater analyst forecast dispersion, uncertainty, and lower forecast accuracy associated with firms with less readable 10-Ks (Lehavy et al., 2011; Bozanic & Thevenot, 2015; Zhang et al., 2019). Lee (2012) contradicts this by showing that poor readability of 10-Q filings dampens stock price efficiency, and this is less pronounced in firms with the higher institutional following and high user sophistication sample. Where proprietary cost is higher for firms, there appears to be a lower fog index reported disclosures (Bova et al., 2015), indicating that stakeholders' ability to use firm disclosures to extract rents from the firm leads to variation in disclosure complexity. The fog index is also found to be related to reduced liquidity, analyst following and institutional ownership (Lang & Stice-Lawrence, 2015). Allee & Deangelis (2015) find that analyst net optimism decreases

where the fog index of prepared remarks section of the conference call is higher. Mattei & Platikanova (2017) find that less readable report increases information asymmetry between management and financial analysts.

### Individual/Small Investors

One of the first studies to provide insight into this post-2008 was Miller (2010), which found that smaller investors are the losers when it comes to foggy reports. The evidence regarding various investor types is centred around whether the effect of considering measures such as the fog index may have more impact on the small investor as opposed to the professional investor. This is supported by studies that have investigated the impact of readability on small investors and concluded that it has a higher impact on individual investors (Lawrence, 2013). There appeared to be limited studies investigating the impact of readability on small investors. Most studies examine the overall capital market effect, which may be skewed towards the larger investors (Hsieh et al., 2016). Hooghiemstra et al. (2017) show that with increased institutional ownership, opportunistic actions of management through unreadable disclosures decreases.<sup>2</sup>

The evidence and current proposals on the relevance of the fog index indicate whether the use of short sentences and short words has an impact on investors, and if so, whether it affects both professional investors and small investors. Given that there is limited evidence on whether and how these long words affect users, this debate still appears inconclusive.

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<sup>2</sup> We note that Bloomfield (2002) discusses investor types based on the rationality of investors within the concept of the incomplete revelation hypothesis. This can be a useful framework to consider how readability can inform this classification.



### **4.3. Disclosure Utility – Contributions to the Accountability Role of Disclosure**

The evidence shows that regulatory disclosures such as the Financial Accounting Standards Board (FASB) and Security and Exchange Commission (SEC) requirements play a role in increasing the fog index of disclosures (Dyer et al., 2017). They show that topics such as fair value, internal controls, and risk factor disclosures account for increased disclosure narrative complexity. This is further confirmed by the study of the role of International Financial Reporting standards and disclosure readability, which shows an increase in the fog index that link to more complex topics such as financial instruments (Lang & Stice-Lawrence, 2015). Bozanic et al. (2019) find that the role of security lawyers extends beyond the specific enquiry by improving the disclosure readability of affected firms. Kubick et al. (2020) observe more readable tax footnotes following clawback adoption. Pinto et al. (2020) find that accounting standards with a higher level of precision lead to less readable auditors' reports.

Since the adoption of International Accounting Standards in 2005, there has been an increasing number of disclosure requirements and subjective management explanations of principles-based standards. Using natural experiments, Rennekamp (2012) finds that readability effects can be independent of ability because information clarity determines processing fluency. This, in turn, impacts the related judgements and decisions (El-Sayed et al. 2021). Limited attention emphasises that salient facts are more easily gleaned by investors (Hirshleifer & Teoh, 2003). Linguistic studies have further shown that longer words and sentences increase text complexity and processing times by individuals (Williamson et al., 2013). Less complex disclosures also create inclusive text, as novice investors have been noted to perform as experts given clear disclosure (Libby et al., 2002). The fog index readability literature will benefit from research that identifies the impact of complexity on investor types given limited attention. This will enhance the interpretation of these results.

## **5. Challenges and Suggestions for a Future Research Agenda**

### **5.1. Firm Complexity and Reporting Outcomes**

Disentangling the findings related to firm environmental complexity as opposed to trends related to narrative obfuscation has been a significant challenge for the usefulness of accounting research that applies the fog index (Loughran & McDonald, 2014). Earlier studies reporting increasing annual report fog indexes in later years (for example, Li, 2008) have been faced with the question of whether the observed changes in narrative fog indexes are associated with performance obfuscation or firm environmental complexity (Bloomfield, 2008). The challenge in making this distinction is that, while an increase in the fog index suggests a reduction in the ease of using disclosure narrative, it also may indicate the narrative's informativeness. Chychyla et al. (2019) note that the fog index of the report is likely to be simultaneously determined by the reporting outcomes, such as the decrease in readability given disclosure of material weakness. Future research could consider tests that can disentangle the components of the disclosure characteristics that explain informativeness versus obfuscating components.

Few studies have attempted to disentangle these components within a specific context outside annual reports (Bushee et al., 2018) or using a specific framework/setting for the investigation (Lo et al., 2017). Thus, it has been difficult to replicate or generalise findings to different settings. However, studies have indicated that a combined measure of informativeness and obfuscation, such as the fog index, leads to ambiguity in its interpretation (Bushee et al., 2018). Further, the combination of studies that apply the fog index as a measure of disclosure quality (Biddle et al., 2009; Callen et al., 2013; Lawrence, 2013; Merkley, 2014) and studies that apply it as a measure of syntactical complexity (Bova et al., 2015; De Franco et al., 2015; Dyer et al., 2017; Lundholm et al., 2014) increases its ambiguity. This has made it difficult for reviewers,

practitioners, and authors to categorise the relevance and application of the fog index in accounting research and practice.

## **5.2. Research questions**

Future research can consider the following questions to address: (i) Can we identify the components of accounting narratives associated with obfuscation? For example, research could test whether the suggested words in Loughran & McDonald (2014) are more easily grasped by users of annual reports, including considering the concept of limited attention for investor types and whether readability affects certain/all investors (Martin, 2019). This will directly address disclosure obfuscation and disclosure utility by showing what investor types are affected by obfuscation and what disclosure components represent obfuscation. (ii) Can researchers identify an informative control setting for annual report disclosures similar to Bushee *et al.*'s (2018) application, which uses the conference calls setting? (iii) Is using fog index as a syntactical complexity measure sufficient in accounting research? For example, the findings of studies that apply the fog index as a measure of syntactical complexity in their research design could be compared to a measure of disclosure quality to shed light on this question. (iv) Does the assumption of 'relative readability' eliminate the challenges of disentangling informativeness and obfuscation? Studies have used the 'relative readability' concept as an overriding factor (Li, 2008)<sup>3</sup>. Some arguments focusing on relative readability in a cross-section mitigate the concern of actual comprehension difficulty (Li, 2008; Fisher *et al.*, 2020). (v) Are natural experiments more powerful tests for addressing the underlying challenge of disentangling the informative components of disclosure from the obfuscating components? Natural experiments are designed to

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<sup>3</sup> Li (2008) notes that the argument that the fog index may not reflect actual comprehension difficulty is mitigated because only looking at readability across firms allows for a measure of high or low readability scores based on average report readability scores (relative readability).

focus on investor types (El-Sayed et al. 2021) and may be suitable for disentangling information and obfuscation. For example, the association between the fog index of informative components of disclosure, as opposed to the fog index of obfuscating components for pre-defined investor types, could be examined.

Future research could benefit from considering the impact of country differences in analysing the annual report's fog index and its impact on investors. Currently, most studies assume that difficult to read words are similar across countries. However, it appears that a United States centric interpretation is imposed on all investors. To consider country differences is also noted in textual analysis reviews (Li, 2010; Elshandidy *et al.*, 2018), although still with limited focus in the current literature. A workaround for future studies is to incorporate the concept of linguistic distance in designing readability models. Another option is to conduct experiments that include country identifiers in test models/dependent variables.

## **6. Conclusions and Limitations of the Review**

This paper reviews the literature on applying fog index to quantifying accounting narratives utilising a SLR approach. The research question is: What are the current proposals relevant to using fog index and, more widely, readability formulas? The paper discusses the review findings on the proposals in the existing literature.

The literature has been limited in addressing the challenge of disentangling the information and obfuscating components of fog index narrative disclosure complexity, and the impact of narrative complexity on investor types remains unclear. Future research on the readability of accounting disclosures will benefit from a research design that disentangles the informative and

obfuscating components when applying the fog index. In addition, considering the disclosure utility of investor types will enhance the interpretation of the fog index disclosure implications.

This review is restricted to fog index-determined accounting narrative studies and does not directly include other disclosure settings that use the fog index or different readability formulas. Further research to add to this review can assess studies of readability beyond corporate report settings that use different measures of readability. The fog index is used as a proxy for constructs of readability. An option would be to review the papers using textual analysis approaches that capture the readability of accounting narratives, including the fog index. The research problems identified with the fog index is not exclusive to the fog index. The authors have addressed this by identifying other measures of readability and discussing their relationship with the fog index to aid readers in understanding how the findings in this review can be applicable beyond the fog index. There are other measures of readability, which may not have been noted in this study because the authors have focused on the more widely used measures when discussing other readability measures.

A key challenge of readability studies is the performance of joint tests in the analysis, which tests the relevance of the formula as a suitable measure and the test of its association with an accounting measure, where one informs the other. We have mitigated this by analysing the measure and considering its application context given existing literature. This gives readers additional context on the use of the index. In discussing a few arguments for and against the fog index we have also relied on anecdotal evidence reported by the literature. We refer to anecdotal because these studies may not have performed tests to support the arguments but have relied on

either statement from previous studies or similar anecdotal evidence from wider expectations.<sup>4</sup> We consider this a useful contribution from this review for readers to consider whether existing arguments in the literature are evidence-based or expectations given the historical development of the index.

Our review is based on a systematic methodology applying word search in identifying articles. In the first instance, we focus on a word search of the fog index to identify only articles in the relevant journals that study the fog index. This may lead to bias towards studies that have used the word ‘fog index’ in their discussions. However, given the uniqueness of the index there are limited studies that use the index without the word ‘fog index’ written in the text. The word analysis is based on keyword analysis. There is the option to use term weights and/or word cloud terms. However, as this section includes anecdotal evidence, we expect that we can increase the significance of the anecdotal evidence captured by using author selected keywords. When performing the keyword in context, we rely on a limited context by using a specified integer count. This may limit our identification of the wider context of using fog index in the study. We mitigate this by widening the integer search and performing a two-step keyword analysis when identifying articles relevant to each context of the discussion. We expect that approaching the literature review in this way allows for replicability using the research tools we have utilised and limits researcher bias in identifying the relevant articles.

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<sup>4</sup> For example, Loughran & McDonald (2014) report that investors may find commonly used longer words easier to understand and base the weakness of the fog index on this assumption. While they perform a market reaction test using the fog index, there is no test to demonstrate the types of words investors may understand or the type of investors that find these words easier to understand.

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## TABLES

### I. Table 1: Systematic Review Protocol

<b>Systematic Review Protocol – Panel A</b>		
1. Purpose	To identify and review the literature on the application of the fog index to quantifying accounting narratives utilizing a systematic literature review approach using automated textual analysis	
2. Research question	What are the current proposals relevant to the use of the fog index and, more widely, readability formulas?	
3. Keyword search	Fog Index	
4. Synonyms	Fog <sup>1</sup>	
6. Sources of articles	Accounting Journals	
7. Inclusion criteria	Focus on articles published between 2008 - 2020 <sup>2</sup>	
8. Exclusion criteria	Non-Accounting Journals	
<b>Sampling – Panel B</b>		
<b>Journal Title</b>	<b>Count</b>	<b>% Count</b>
Accounting Review	18	14.29%
Journal of Accounting and Economics	17	13.49%
Review of Accounting Studies	17	13.49%
Contemporary Accounting Research	13	10.32%
Journal of Accounting Research	13	10.32%
Journal of Accounting and Public Policy	12	9.52%
European Accounting Review	8	6.35%
Journal of Business Finance and Accounting	8	6.35%
Accounting and Business Research	7	5.56%
Accounting, Auditing and Accountability Journal	6	4.76%
Accounting, Organizations and Society	3	2.38%
Abacus	2	1.59%
British Accounting Review	1	0.79%
Journal of International Accounting, Auditing and Taxation	1	0.79%
<b>Grand Total</b>	<b>126</b>	<b>100.00%</b>

<sup>1</sup> We focus on the keyword fog index to retrieve articles that address the arguments for or against the index. We also use the keyword fog but find that using the keyword 'fog' introduces noise, specifically the search finds articles that use the word 'fog' to clarify the fogginess of written language in the text rather than a reference to the fog readability formula.

<sup>2</sup> Focus on studies from 2008 since the year of the first large-sample accounting publication using the fog index. We also found that the full text of older articles is usually more difficult to parse with the text analysis software.

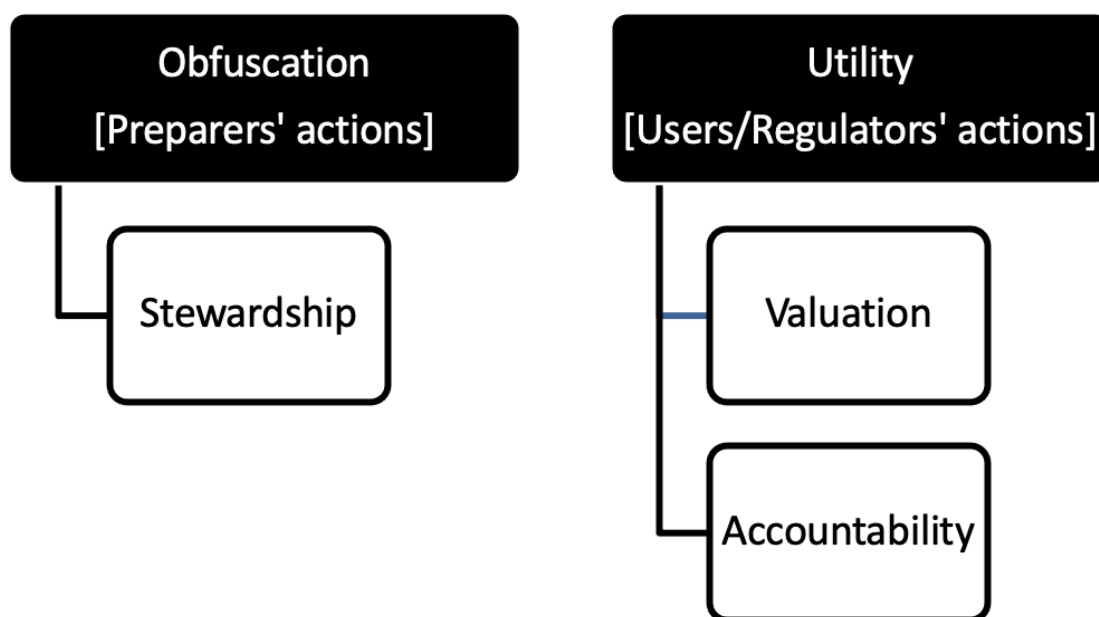
**II. Table 2: Themes in Fog Index Studies**

Word Themes	Length	Count	Weighted Percentage	Similar Words	Function of corporate disclosures <sup>3</sup>	Fog Index Literature Current Proposals
disclosure	10	64	6.65%	disclosure, disclosures	Stewardship	Disclosure Obfuscation
reports	7	37	3.84%	report, reporting, reports	Stewardship	Disclosure Obfuscation
readability	11	25	2.60%	readability	Stewardship	Disclosure Obfuscation
analysis	8	24	2.49%	analysis	Stewardship	Disclosure Obfuscation
financial	9	21	2.18%	financial	Stewardship	Disclosure Obfuscation
textual	7	19	1.97%	textual	Stewardship	Disclosure Obfuscation
information	11	18	1.87%	information	Stewardship	Disclosure Obfuscation
analysts	8	15	1.56%	analyst, analysts	Valuation	Disclosure Utility
management	10	15	1.56%	management	Stewardship	Disclosure Obfuscation
earnings	8	14	1.45%	earnings	Stewardship	Disclosure Obfuscation
market	6	12	1.25%	market, markets	Valuation	Disclosure Utility
risk	4	11	1.14%	risk	Valuation	Disclosure Utility
forecast	8	11	1.14%	forecast, forecasting, forecasts	Valuation	Disclosure Utility
costs	5	11	1.14%	cost, costs	Stewardship	Disclosure Obfuscation
narrative	9	10	1.04%	narrative, narratives	Stewardship	Disclosure Obfuscation
accounting	10	10	1.04%	accounting	Stewardship	Disclosure Obfuscation
regulation	10	10	1.04%	regulation	Accountability	Disclosure Utility
voluntary	9	10	1.04%	voluntary	Stewardship	Disclosure Obfuscation

<sup>3</sup> valuation (decision usefulness criteria for capital providers); stewardship (full and transparent information allows monitoring of that capital); accountability (an account of the actions for which an organization is held responsible in the eyes of all its stakeholders). (Michelon, 2020)

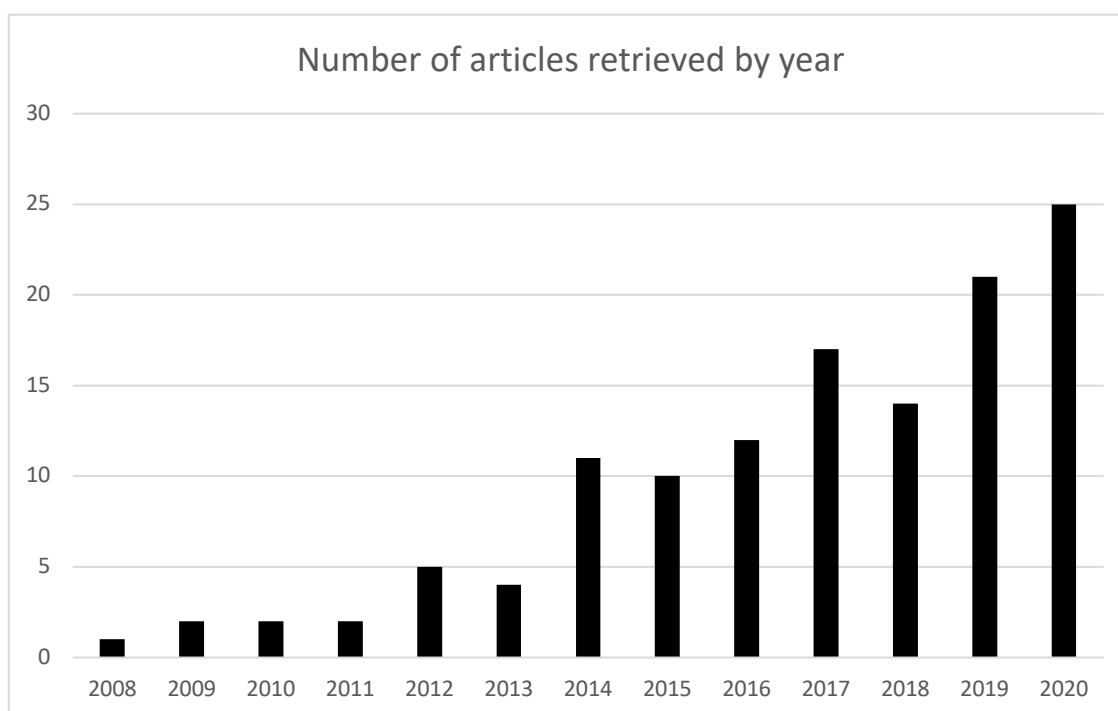
## FIGURES

### I. Concept Map



*This figure shows the theoretical concept map based on the organisation of the review*

### II. Figure 1: Articles Retrieved



*This figure indicates the increase in the publication of articles referencing the fog index as a readability formula for accounting disclosure studies.*

## Appendix

### I. A1: Journal Search

Journal id	Journal Title	Articles found <sup>1</sup>	No. of Articles
1	The Accounting Review	(Bens et al., 2016; Bowen et al., 2014; Bozanic et al., 2019; Brochet et al., 2019; Brochet et al., 2016; D'Augusta & DeAngelis, 2020; Glendening et al., 2019; Goodman et al., 2014; Hoitash & Hoitash, 2018; Kim et al., 2013; Kubick et al., 2020; Lehavy et al., 2011; Li, 2016; Lundholm et al., 2014; Merkley, 2014; Miller, 2010; Schloetzer et al., 2020; Asay et al., 2017)	18
2	Journal of Accounting and Economics	(Arif et al., 2019; Asay et al., 2018; Berger, 2011; Biddle et al., 2009; Blankespoor et al., 2020; Bonsall et al., 2017; Chychyla et al., 2019; Dyer et al., 2016, 2017; Frankel et al., 2016; Guay et al., 2016; Heese et al., 2017; Lang & Stice-Lawrence, 2015; Lawrence, 2013; Li, 2008; Lo et al., 2017; Miller, 2017) <sup>2</sup>	17
3	Review of Accounting Studies	(Arora et al., 2014; Bhattacharya et al., 2020; Blankespoor et al., 2014; Bonsall & Miller, 2017; Brochet et al., 2015; Campbell et al., 2014; Cao et al., 2017; Cardinaels et al., 2019; Cassell et al., 2019; Donovan et al., 2020; Fang & Hope, 2021; Frankel et al., 2018; Hope et al., 2016; Koo et al., 2017; Kravet & Muslu, 2013; Mattei & Platikanova, 2017; Truong et al., 2021)	17

<sup>1</sup> In retrieving the arguments for/against the fog index, we focus on articles that have studied corporate filings. Thus, not all the articles reported in this table are cited in-text. We include articles cited in-text in the list of references.

<sup>2</sup> A total of 15 articles were identified using the search string 'fog index' and 2 articles were identified from the search string 'fog'. More broadly other articles appearing in the search had no mention of the word 'fog/fog index' in the pdf of the article download.



4	Contemporary Accounting Research	(Bao et al., 2018; Beatty et al., 2019; Bonsall et al., 2017; Bova et al., 2015; Bozanic & Thevenot, 2015; Callen et al., 2013; Chen et al., 2019; De Franco et al., 2015; Filzen & Peterson, 2015; Heese, 2019; Kim et al., 2019; Lee, 2012; Lin et al., 2019)	13
5	Journal of Accounting Research	(Allee et al., 2018; Allee & Deangelis, 2015; Blankespoor, 2019; Brown et al., 2020; Bushee et al., 2018; Cascino et al., 2019; Chen et al., 2015; Hutton et al., 2012; Law & Mills, 2015; Li, 2010; Li & Zhang, 2015; Loughran & McDonald, 2016; Rennekamp, 2012)	13
12	Journal of Accounting and Public Policy	(Balsam et al., 2016; Blanco et al., 2021; Bozanic et al., 2017; Ettredge et al., 2018; Hossain et al., 2020; Kuang et al., 2020; Laksmna et al., 2012; Lim et al., 2018; Lobo et al., 2019; Melloni et al., 2017; Nguyen & Kimura, 2020; Twedt & Rees, 2012)	12
13	Journal of Business Finance and Accounting	(Hemmings et al. 2020; Zhang et al. 2019; Chen et al. 2021; Hsieh et al. 2016; Li 2019; El-Haj et al. 2019; Chen 2016; Jung et al. 2016)	8
11	European Accounting Review	(Athanasakou et al., 2020; Caglio et al., 2020; Cannon et al., 2020; Chen & Tseng, 2020; Hasan, 2018; Mittelbach-Hörmanseder et al., 2020; Nguyen, 2020; Wisniewski & Moro, 2014)	8
8	Accounting and Business Research	(Brennan and Merkl-Davies 2018; El-Haj et al. 2020; Hooghiemstra, Kuang, and Qin 2017; Lev 2018; Lewis and Young 2019; Libby and Emett 2014; Xu et al. 2020)	7

9	Accounting, Auditing and Accountability Journal	(Stone and Lodhia 2019; Aerts and Yan 2017; Fisher et al. 2019; Jones and Smith 2014; Brennan et al. 2009; Buchholz et al. 2018) <sup>3</sup>	6
2	Accounting, Organizations and Society	(Barth et al. 2017; Stenka and Jaworska 2019; Teoh 2018)	3
7	Abacus	(Clarkson et al. 2020; Krause, Sellhorn, and Ahmed 2017)	2
10	British Accounting Review	(Beattie 2014)	1
14	Journal of International Accounting, Auditing and Taxation	(Pinto, Morais, and Quick 2020)	1
	Total ACCOUNT articles		126

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<sup>3</sup> We exclude Courtis (1995) and Jones (1996) both published in the *Accounting, Auditing and Accountability Journal*, from the reported search results as these are before 2008.

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## II. A2: Article Review

Journal	Reference	Sample period	Corpus	Sample Size	Average fog	Main Variable (Association with fog index <sup>4</sup> )	Research Contribution
<b>2008</b>							
JAE	Li, F.	1993-2003	10-K <sup>5</sup>	55,719	19.39	Earnings (-ve)	Obfuscation
JAE	Li, F.	1993-2003	MD&A <sup>6</sup>	43,335	18.23	Earnings (-ve)	Obfuscation
JAE	Li, F.	1993-2003	Notes <sup>7</sup>	48,336	18.96	Earnings (-ve)	Obfuscation
<b>2009</b>							
JAE	Biddle et al.	1993-2005	10-K <sup>8</sup>	20,443	-19.31 <sup>9</sup>	Investment (-ve)	Obfuscation
<b>2010</b>							
JAR	Li, F.	1994-2007	MD&A	145,479 <sup>10</sup>	18.31	Positive tone (-ve)	Obfuscation
TAR	Miller, B.	1994-2006	10-K	12,771	19.43	Trading volume (-ve) <sup>11</sup>	Utility
<b>2011</b>							
TAR	Lehavy et al.	1995-2006	10-K	57,642	19.52	Analyst uncertainty (-ve)	Utility
<b>2012</b>							
JAR	Hutton et al.	2001-2007	10-K	3,775	19.53	Forecast accuracy (+ve) <sup>12</sup>	Utility

<sup>4</sup> This is the main variable as reported in the study's hypothesis. Where there are no signs of association of the main variable with the fog index reported in study, we note the study's theoretical application of the fog index.

<sup>5</sup> 10-K filing usually refers to the periodic filing for United States firms

<sup>6</sup> Management Discussion and Analysis

<sup>7</sup> Notes to the financial statements

<sup>8</sup> Biddle et al (2009) uses the term financial statement readability obtained from Li (2008) to define its corpus. We assume this is the 10-K readability given the mean fog is consistency with Li (2008) 10-K mean fog.

<sup>9</sup> Biddle et al (2009) multiplies the fog index by minus one so that it is increasing in reporting quality

<sup>10</sup> Firm quarters

<sup>11</sup> Miller (2010) uses abnormal trading volume. The negative association with the fog index is not significant

<sup>12</sup> Indicator variable set to 1 when the absolute value of the management forecast error is smaller than the absolute value of the analyst forecast error.

Journal	Reference	Sample period	Corpus	Sample Size	Average fog	Main Variable (Association with fog index <sup>4</sup> )	Research Contribution
JAPP	Laksmana et al.	2006-2007	CD&A <sup>13</sup>	895	21.94 <sup>14</sup>	Excessive CEO pay (+ve)	Obfuscation
CAR	Lee, Y.	2001-2007	10-Q <sup>15</sup>	60,161 <sup>16</sup>	20.55	Stock price efficiency (-ve)	Utility
JAPP	Twedt & Rees	2006	Analyst report	2,057	16.96	Market response (+ve)	Utility
<b>2013</b>							
CAR	Callen et al.	1981-2006	Annual reports	29,345	-	Stock price delay (+ve)	Obfuscation
TAR	Kim et al.	1989-2008	Financial report	-	-	Transparency	Obfuscation
RAS	Kravet & Muslu	1994-2007	10-K	28,110	0.007 <sup>17</sup>	Return volatility (+ve)	Obfuscation
JAE	Lawrence, A.	1994-1996	10-K	1,555	19.02	Individual Holdings (+ve) <sup>18</sup>	Utility
<b>2014</b>							
RAS	Arora et al.	2007-2009	Financial report	1,115 <sup>19</sup>	-	Asset reliability (+ve)	Obfuscation
RAS	Blankespoor et al.	2009-2010	10-K	-	-	Complexity	Obfuscation
TAR	Bowen et al.	1980-2006	MD&A	624 <sup>20</sup>	19.419	Transparency	Obfuscation
RAS	Campbell et al.	2005-2008	10-K	9,076	19	Firm risk (+ve)	Obfuscation
RAS	Campbell et al.	2005-2008	MD&A	8,099	18	Firm risk (+ve)	Obfuscation
RAS	Campbell et al.	2005-2008	Risk disclosures	9,076	21	Firm risk (+ve)	Obfuscation
TAR	Goodman et al.	-	-	-	-	Reporting quality	Obfuscation
TAR	Lundholm et al.	2000-2012	20-F <sup>21</sup> (MD&A)	3,449	17.54	Disclosure readability (-ve)	Obfuscation
TAR	Merkley K.	1996-2007	10-K R&D	22,482	23.57	-	-

<sup>13</sup> Compensation Discussion and Analysis

<sup>14</sup> This reports the average of the fog index score reported in table 1 for the 2007 proxy season (FY 2006) and 2008 proxy season (FY 2007)

<sup>15</sup> Quarterly filings

<sup>16</sup> Firm quarters

<sup>17</sup> Measures the change in fog index

<sup>18</sup> Fog index score is multiplied by -1 so that larger values imply higher financial disclosure quality. This is observed in studies using the fog index as a measure of quality.

<sup>19</sup> Firm-months

<sup>20</sup> Representing a specific case study – Berkshire holdings

<sup>21</sup> Annual filings by foreign firms usually listed in the United States Stock market

Journal	Reference	Sample period	Corpus	Sample Size	Average fog	Main Variable (Association with fog index <sup>4</sup> )	Research Contribution
TAR	Merkley K.	1996-2007	10-K Earnings	22,482	18.62	Earnings (-ve)	Obfuscation
EAR	Wisniewski & Moro	1993-2012	EC Disclosures <sup>22</sup>	75	-	Stock returns (-ve)	Utility
<b>2015</b>							
JAR	Allee & Deangelis	2004-2014	Conference calls	33,428	14.603 <sup>23</sup>	Analyst response (-ve)	Utility
CAR	Bova et al.	1999-2007	10-K	22,452	19.957	Proprietary cost (-ve)	Utility
CAR	Bozanic & Thevenot	1984-2012	Earnings release	1,838	16.898	Information uncertainty (+ve)	Obfuscation
RAS	Brochet et al.	2002-2008	Conference calls	70,042	-	Earnings management (+ve)	Obfuscation
JAR	Chen et al	1993-2011	MD&A	41,692	-	Disclosure quality	Obfuscation
CAR	De Franco et al.	2002-2009	Analyst reports	356,463	18.71	Abnormal volume (+ve)	Utility
CAR	Filzen & Peterson	1994-2008	Accounting policies	85,266	19.34	Reporting complexity(+ve)	Obfuscation
JAE	Lang & Stice-Lawrence	1998-2011	Annual reports	85,793	19.520	Economic consequences(-ve)	Utility
JAR	Law & Mills.	2007-2011	10-K	4,205	19.836	Negative words	Obfuscation
JAR	Li & Zhang	2003-2007	10-K	7,471	-	Bad news report (+ve)	Obfuscation
<b>2016</b>							
TAR	Brochet et al.	2002-2010	Press release	6,366	15.71	Transparency	Obfuscation
TAR	Brochet et al.	2002-2010	Presentation	11,305	13.73	Transparency	Obfuscation
JAE	Dyer et al	200-2011	10-K	-	-	Time trends	Obfuscation
JAE	Frankel et al.	1994-2013	10-K	74,080	-	Accruals	Obfuscation
JAE	Guay et al.	1995-2012	10-K	72,366	-0.01 <sup>24</sup>	Voluntary disclosures (+ve)	Obfuscation
RAS	Hope et al.	2006-2011	10-K	14,865	19.94	Readability	Obfuscation
JBFA	Hsieh et al.	2005-2007	Analyst reports	3,554	14.01	Market reaction (+ve) <sup>25</sup>	Valuation

<sup>22</sup> European Council documents that are the direct outcome of 75 meetings held between June 1993 and January 2012.

<sup>23</sup> Fog index of the prepared remarks section of the conference call

<sup>24</sup> The study uses *readindex* readability measure which is the first principal component of six readability measures including the fog index

<sup>25</sup> Readability is calculated as the Fog Index multiplied by -1 and then standardised between 0 and 1. This positive association is interpreted market reacts positively to a more-readable reports

Journal	Reference	Sample period	Corpus	Sample Size	Average fog	Main Variable (Association with fog index <sup>4</sup> )	Research Contribution
JBFA	Jung et al.	1988-2010	-	4,958	-	Transparency	Obfuscation
TAR	Li, V.	1975-2008	-	-	-	Information asymmetry	Obfuscation
JAR	Loughran & McDonald	-	-	-	-	Complexity	Obfuscation
<b>2017</b>							
AAAJ	Aerts & Yan	2006-2010	Annual reports	498	-	Transparency	Obfuscation
AOS	Barth et al.	2011-2014	Integrated reports	292	16.34	Disclosure quality	Obfuscation
CAR	Bonsall et al.	1994-2013	Tax footnotes	4,780	19.029	Ratings Convergence (+ve)	Obfuscation
JAE	Bonsall et al.	1996-2000	Prospectus	772	22.52	Plain English Attributes	Obfuscation
JAE	Bonsall et al.	1994-2011	10-K	66,173	19.35	Return volatility (+ve)	Obfuscation
RAS	Bonsall & Miller	1994-2014	10-K	3,659	19.397	Credit ratings (+ve)	Utility
JAPP	Bozanic et al.	1	Annual reports	5,504	20.3	Transparency	Obfuscation
JAE	Dyer et al.	1996-2013	10-K	75,991	21.34	Regulation (+ve)	Utility
JAE	Heese et al.	2005-2012	Comment letters	33,084	20.07	Linguistic complexity	Obfuscation
ABR	Hooghiemstra et al.	2003-2009	Remuneration report	1,426 <sup>26</sup>	0.002 <sup>27</sup>	Dissent (-ve)	Obfuscation
RAS	Koo et al.	1996-2011	10-K	17,695	-	Reporting quality	Obfuscation
JAE	Lo et al.	2000-2012	MD&A	26,967	26,967	Earnings Management	Obfuscation
RAS	Mattei & Platikanova	1997-2013	Financial reports	25,070	19.99	Information Asymmetry (tve)	Utility
JAPP	Melloni e al.	2013-2014	Integrated report	104	16.1289	Social performance (-ve)	Obfuscation
JAE	Miller, G.	-	-	-	-	Discussion	Obfuscation
TAR	Asay et al	-	-	-	-	Readability	Utility
<b>2018</b>							
JAR	Allee et al.	1	1			Scriptability/Valuation	Utility
JAE	Asay et al.	-	-	-	-	Information	Obfuscation

<sup>26</sup> FTSE350 firms

<sup>27</sup> Combines the factor index and length in its obfuscation measure

Journal	Reference	Sample period	Corpus	Sample Size	Average fog	Main Variable (Association with fog index <sup>4</sup> )	Research Contribution
CAR	Bao et al	2003-2011	10-K	-	-	Managerial opportunism	Obfuscation
JAR	Bushee et al.	2002-2011	Call presentation	60,172	15.861	Information asymmetry	Obfuscation
JAR	Bushee et al.	2002-2011	Call response	60,172	11.956	Information asymmetry	Obfuscation
JAR	Bushee et al.	2002-2011	Call analyst	60,172	11.956	Information asymmetry	Obfuscation
CAR	Chiu et al.	2005-2009	10-K	-	-	Disclosure quality	Obfuscation
JAPP	Ettredge et al.	2007-2015	10-K	39,992	3.129 <sup>28</sup>	Information asymmetry	Obfuscation
RAS	Frankel et al.	2012-2016	10-K	229	20.640	Proprietary costs	1
EAR	Hasan, M.	1994-2015	56,568	-	-	Managerial ability	Obfuscation
TAR	Hoitash & Hoitash	2011-2014	10-K	11,972	19.330	Complexity	1
JAPP	Lim et al.	1989-2011	Annual report	21,660	19.458	Business strategy (+ve)	Obfuscation
AOS	Teoh, S.	-	-	-	-	Review	Both
<b>2019</b>							
JAE	Arif et al.	11995-2016	10-K	-	19.11	Reporting complexity	Obfuscation
CAR	Beatty et al.	2005-2014	Risk disclosures	6,501	20.930	Reporting complexity	Obfuscation
CAR	Beatty et al.	2005-2014	MD&A	6,501	17.788	Reporting complexity	Obfuscation
CAR	Beatty et al.	2005-2014	Other sections	6,501	18.688	Reporting complexity	Obfuscation
JAR	Blankespoor, E.	2006-2014	Footnotes	25,683	19.8	XBRL disclosures (-ve)	Obfuscation
TAR	Bozanic et al.	2005-2012	10-K	9,822	20.11	SEC regulation	Utility
TAR	Brochet et al.	2002-2012	Call transcripts	129,787	11.49	Linguistic opacity	Obfuscation
RAS	Cardinaels et al.	-	Earnings release	-	-	Disclosure attributes	Obfuscation
JAR	Cascino et al.	-	-	-	_ <sup>29</sup>	Regulation	Utility
RAS	Cassell et al.	2004-2014	Comment responses	14,096	20.126	Information cost (+ve)	Obfuscation
CAR	Chen et al.	1998-2011	Earnings forecasts	5,328	17.16	Investment efficiency (-ve)	Obfuscation

<sup>28</sup> Log fog index

<sup>29</sup> Measures readability using the Flesch-Kincaid grade level and notes that it is strongly correlated with the fog index

Journal	Reference	Sample period	Corpus	Sample Size	Average fog	Main Variable (Association with fog index <sup>4</sup> )	Research Contribution
JAE	Chychyla et al.	2011-2014	10-K	-	-	Accounting expertise(+ve)	Obfuscation
JBFA	El-Haj et al.	-	-	-	-	Review	Both
AAAJ	Fisher et al.	2008-2009	CSR & Annual report <sup>30</sup>	818 <sup>31</sup>	18.31	Tone	Obfuscation
TAR	Glendening et al.	2002-2010	10-K	2,615	17.978	Reporting quality	Obfuscation
CAR	Heese, J.	1994-2012	10-K	-	-	Accounting complexity	Obfuscation
CAR	Kim et al.	1994-2014	10-K raw fog	52,879	12.957	Stock price crash risk	Utility
CAR	Kim et al.	1994-2014	10-K modified fog	52,879	19.957	Stock price crash risk (+ve)	Utility
JBFA	Li, H.	1995-2013	MD&A	49,665	20.74	Repetitive disclosures	Obfuscation
JAPP	Lobo et al.	1999-2016	Item 7A	19,890	20.320	Return volatility	Obfuscation
JAPP	Lobo et al.	1999-2016	MD&A	19,890	21.850	Return volatility	Obfuscation
JAPP	Lobo et al.	1999-2016	10-K	19,890	21.907	Return volatility	Obfuscation
AAAJ	Stone & Lodhia	2011-2015	Integrated reports	-	-	Readability	Obfuscation
JBFA	Zhang et al.	1998-2012	MD&A	34,264	18	Analyst following (mixed) <sup>32</sup>	Utility
<b>2020</b>							
EAR	Athanasakou et al.	2003-2014	Perf. commentary <sup>33</sup>	5,152	0.59	Cost of equity	Obfuscation
RAS	Bhattacharya et al.	-	-	-	-	Earnings response	Obfuscation
JAPP	Blanco et al.	-	-	-	-	Audit delay/fees (+ve)	Obfuscation
JAE	Blankespoor et al.	-	-	-	-	Disclosure costs review	Obfuscation
JAR	Brown et al.	1994-2012	10-K	42,314	17.9 <sup>34</sup>	Disclosure topics	Obfuscation
EAR	Caglio et al.	2011-2016	Integrated reports	679	23.339	Market valuation (-ve)	Utility

<sup>30</sup> Standalone CSR reports are separated into two sub-sections: the opening statements and the main disclosure sections. Annual reports are separated into four sub-sections: the chairman's statement, any dedicated CSR sections, OFR (or equivalent) sections and, finally, the financial statement notes.

<sup>31</sup> A total of 215 individual texts were identified and extracted from the NZX50 companies, while 603 were extracted from ASX100 companies.

<sup>32</sup> Higher readability associated with less analyst following, higher analysts' earnings forecast dispersion and less analysts' earnings forecast accuracy.

<sup>33</sup> Management performance commentary

<sup>34</sup> 10-K/A irregularity sample



Journal	Reference	Sample period	Corpus	Sample Size	Average fog	Main Variable (Association with fog index <sup>4</sup> )	Research Contribution
EAR	Cannon et al.	1996-2015	10-K	50,757	19.826	CSR disclosure	Obfuscation
EAR	Chen & Tseng	2003-2012	Notes	11,604	15.958	Bond yield spread	Utility
EAR	Chen & Tseng	2003-2012	MD&A	11,604	15.893	Bond yield spread	Utility
JBFA	Chen et al.	1996-2012	Good AQ <sup>35</sup> reports	98,938	17.737	Return predictability	Utility
JBFA	Chen et al.	1996-2012	Poor AQ reports	103,404	21.258	Return predictability	Utility
TAR	D'Augusta & DeAngelis	1993-2013	MD&A	-	-	Tone concavity (-ve)	Obfuscation
ABR	El-Haj et al.	2003-2014	Annual reports	586	-	Textual analysis	Obfuscation
RAS	Fang & Hope	-	Analyst reports	-	-	Narrative attributes	Obfuscation
JBFA	Hemmings et al.	2010-2014	CD&A	2,686	23.59	Shareholder dissent (+ve)	Obfuscation
JAPP	Hossain et al.	2000-2014	Annual reports	11,148	-	Report complexity	Obfuscation
TAR	Kubick et al.	2004-2012	Tax footnotes	2,635	-	Clawback adoption	Utility
EAR	Mittelbach-Hörmanseder et al.	2008-2016	CSR disclosures	3,961	13	Regulation	Utility
EAR	Nguyen, J.	1994-2015	10-K	29,531	19.341	Tax avoidance	Obfuscation
EAR	Nguyen, J.	1994-2015	Tax footnotes	7,671	15.056	Tax avoidance	Obfuscation
JAPP	Nguyen & Kimura,	2004-2013	Form 20-F	1,522	19.86	Disclosure length	Obfuscation
JIAAT	Pinto et al.	2016	Key Audit Matters	135	14.1	Accounting standards (+ve)	Utility
TAR	Schloetzer et al.	2005,2011,2012	Event disclosure	209	18.09	Blame attribution	Obfuscation
RAS	Truong et al.	1995-2015	10-K	2,084		Customer satisfaction	Obfuscation
ABR	Xu et al.	2006-2014	Annual reports	12,742	20.12	Political corruption	Obfuscation
<b>Grand Total</b>		<b>107</b>					

<sup>35</sup> Accounting Quality