Research in International Business and Finance 48 (2019) 59–74

Contents lists available at ScienceDirect

Research in International Business and Finance

journal homepage: www.elsevier.com/locate/ribaf

The linguistic complexities of narrative accounting disclosure on financial statements: An analysis based on readability characteristics

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ARTICLE INFO

Keywords:
Readability
Narrative accounting disclosures
Management obfuscation hypothesis

ABSTRACT

Managers can intentionally reduce the readability of narrative accounting disclosures by making them more complex. This assumption is theoretically called the management obfuscation hypothesis. This study investigates the relationship between readability of these narratives and financial performance, arguing that managers elaborate more complex narrative accounting disclosures when performance is poor. Using panel data for a main sample of 1643 firm-years and a secondary sample of 1297 firm-years for the period from 2010 to 2016, it was found that managers deliberately add complexity to narrative accounting disclosures in order to hide information about poor performance. The findings are consistent with the management obfuscation hypothesis and contribute to the understanding that the complex narratives are used as subterfuge for hiding negative financial information. It has also been shown that complex past information has a negative impact on the firms' current performance. Therefore, it seems reasonable to conclude that there is an agreement that complex narratives are less effective and costlier in the analysis process. Our results assist capital market participants to demand more understandable and useful information for decision making.

1. Introduction

Financial statements are considered the main means of communication of firms, and they offer elements for quantitative and qualitative accounting disclosures, useful, in theory, for decision-making (Courtis, 1987). The complexity of the explanatory language used in narrative accounting disclosures makes information more difficult to extract, and is used as a ruse for managers to overshadow information when, for example, performance is poor (Bloomfield, 2002). Consistent with this argument, recent literature shows evidence that complex narrative accounting disclosures are negatively related to a firm's earnings (Ajina et al., 2016; Davis et al., 2012; Li, 2008; Lo et al., 2017).

Readability can be considered a measure of textual complexity. For Smith and Taffler (1992), in accounting, readability is measured by the degree of difficulty found in a text and its relation to the understanding of the message. As for Li (2008), readability can be understood by specific measures, such as the size of the text.

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https://doi.org/10.1016/j.ribaf.2018.12.008
Received 8 July 2018; Received in revised form 21 October 2018; Accepted 9 December 2018
Available online 11 December 2018

The literature on readability focuses on analyzing documents written in English and produced in developed countries. For Li (2010) and Merkl-Davies (2007), this fact makes it difficult to generalize the findings present in literature, suggesting the need for studies about narratives in languages other than English. It is important to say that generalization is also reduced due to the specificities of the environment. Markets characterized by concentrated shareholding may promote the expropriation by the majority against minority shareholders (Shleifer and Vishny, 1997), especially in countries with low legal protection (La Porta et al., 2000). In this way, the environment of information in the firms influence how messages are disseminated (Guay et al., 2016).

Analyzing the narrative accounting disclosures is important to clarify whether more complex information is deliberately sent by managers to change readers' perceptions (Clatworthy and Jones, 2001; Rutherford, 2005). The managerial opportunism, encouraged by the management obfuscation hypothesis – where textual complexity is used to obfuscate negative outcomes (Bloomfield, 2002) – can culminate in more complex information.

Using computational linguistic techniques, Li (2008) investigated the relationship between readability of annual reports and financial performance. The results showed that annual reports from firms with lower earnings are also less intelligible and firms with easier to read reports have greater and more persistent earnings. Bloomfield (2008) suggests that the results of Li (2008) should be interpreted with caution. The researcher provides two additional explanations for the management obfuscation hypothesis considering these variations of ontology. He proposes that the losses make managers more inclined to provide further explanations in order to elucidate the negative outcomes. Another explanation would be that, due to the assumption of accounting conservatism, losses should be explained in more detail to enable future analysis of the firm's situation.

Shedding light on this discussion, Lo et al. (2017) explore how readability of annual reports is presented in relation to the earnings management. Using the main measure of readability adopted by Li (2008), the authors find that firms with greater incentive to manage results in order to overcome the earnings of the previous year show less readable information. Both research focus on the US stock market by investigating narrative accounting disclosures in English.

Due to the evidence reported, the assumption in this research is that narrative accounting disclosures from firms with negative earnings are more difficult to read due to information obfuscation. Thus, the following research question is posed: what is the relationship between the readability of narrative accounting disclosures and financial performance? The objective of the research is to identify the relationship between readability of narrative accounting disclosures and the earnings of the firms that are listed in the Brazilian stock market. The research environment was chosen because: a) it responds to a suggestion by Li (2010) and Merkl-Davies (2007), who advocate for studies in languages other than English; b) of an exogenous informational factor on the Brazilian accounting narratives from 2010; c) Brazil is a country with characteristics of property structure concentrated with low protection to minority shareholders, which, a priori, encourages management obfuscation hypothesis; and d) it is essential to clarify the conceptual criticisms raised by Rutherford (2016).

Although considered an important topic, there are criticisms about the research using readability in the area of accountancy, namely: (i) manual coding is costly (Fisher et al., 2010); (ii) the size of the samples, in general, is small (Fisher et al., 2010; Jones and Shoemaker, 1994), which may explain some mixed findings (Li, 2008); (iii) the use of the most popular linguistic formulas were developed for writing in English, limiting their applicability (Curto and dos, 2014); (iv) readability is poorly specified when using formulas derived from computational linguistics given the nature of their calculation (Loughran and McDonald, 2014). Thus, even with the extensive use of traditional computational formulas, some researchers recommend using complementary measures and/or alternatives for readability (Li, 2010; Loughran and Mcdonald, 2016; Loughran and McDonald, 2014).

To circumvent the problem of item (i), a specific part of the reference form (RF), which contains information on the financial performance of firms listed on the Brazilian stock exchange (B3) was analyzed, which enabled a longitudinal analysis between 2010 and 2016. This procedure also made it possible to avoid the criticism of item (ii). To mitigate problems of readability proxies – criticisms of items (iii) and (iv) – three main variables were calculated. The first variable is the natural logarithm of the archive's size (Bonsall et al., 2017; Ertugrul et al., 2017). Proposed by Loughran and McDonald (2014), the reasoning behind this choice is the assumption that both narrative and visual information interfere with reading texts, so larger articles can be more costly to read and more difficult to extract information. The second variable is the natural logarithm of the number of words (Lawrence, 2013; Li, 2008). The underlying idea is that longer documents, backed up by the management obfuscation hypothesis, may dissuade the reader. The third variable is the number of pages in the narrative. This variable is used to capture the extent to which the disclosure is a complementary measure of the previous variables.

To test the alternative obfuscation hypothesis, three measures of financial performance were used: return on assets, earnings per share and direction of outcomes. The relationship between readability and earnings was controlled by factors identified in previous research. The possibility that the persistence of the readability measures presents an explanatory characteristic about the financial performance of the firms was also tested, using these variables to explain the gains.

This research joins the academic debate that readability is related to financial performance. Specifically, the study contributes to the understanding that the narrative accounting disclosure can be viewed as a way of hiding negative financial information. Its importance is verified by analyzing the characteristics of the information, not its content, which makes the results of the research expandable and interrelated with numerous topics in accountancy and with several areas of knowledge. It contributes to the literature by utilizing a scenario that is not mainstream research, which allows an understanding that the management obfuscation hypothesis is a global phenomenon. The study meets the concerns of Li (2010) and Merkl-Davies (2007), and mitigates the criticisms of Rutherford (2016).

The findings are useful to capital market participants, providing evidence for investors to identify the accurate and transparent financial information. The study also offers subsidies for regulators and decision makers to apply public policies to mitigate the use of complex information at the local level since there is no regulation for universal writing standards for accounting narratives.

2. Literature review

2.1. Application of readability and its application in accounting research

Understanding a text involves several factors, in particular factors that have to do with the text, the reader and the pedagogical intervention (Leffa, 1996). Readability is an element related to the written text. Readability is about measuring how difficult it is to understand a text, considering the use of frequent and complex syntactic structures.

According to DuBay (2004), research on readability appeared in American schools in the 19th century, and in the 20th century, researchers focused on the application of syntactic and semantic metrics to design formulas that captured the level of text comprehension. The author points out that until 1980 there were approximately 200 basic readability formulas for texts written in English.

Readability is essentially responsible for the success in communicating the written message to the interested parties, and presents the degree of complexity of the information. Smith and Taffler (1992) understand that the success in the communication of the message is linked to the level of readability of the narrative accounting disclosure. If a message is not correctly understood, it cannot be adequate for monitoring or decision-making (Jones, 1988). Thus, given the effort to meet the information needs of users, clear and effective communication that facilitates understanding is a necessary feature of effective reporting (Schroeder and Gibson, 1990).

Clear and readable messages are vital to helping non-sophisticated investors understand the firm (Fasb, 2004). Complexity leads to more time and effort to extract important information, which jeopardizes investors' analysis (Bloomfield, 2002). In this way, the environment of information is hampered by an increase in the complexity of the information.

Although relevant, this topic has been little debated in academic research. Jones and Shoemaker (1994) reviewed 32 studies on readability in the fields of accounting, commercial communication, and management, and found 26 research works about annual reports, three about tax legislation, and three about textbooks on accountancy. The overall conclusion of the research is that the corporate annual reports are difficult to read, and are considered as technical literature. However, the research identified were limited in terms of sample size and period of analysis, which impaired the generalization of the results (Fisher et al., 2010; Jones and Shoemaker, 1994). Moreover, it is important to stress that these studies analyzed characteristics of texts written in English.

In the last decade the research on readability gained notoriety from the seminal study by Li (2008). In this study, Li (2008) explored the relationship between readability of the annual reports – as measured by the Fog index developed by Robert Gunning and the natural logarithm of the number of words – and financial performance – measured by the relation of the operating profit to the total assets of the firms listed in the US stock market between 1993 and 2003. The results showed that annual reports of firms with lower earnings are less intelligible and firms with easier to read reports have greater and more earnings persistence.

Based on and expanding previous research, Lo et al. (2017) explore how readability of annual reports is presented in relation to earnings management. Using the main measure of readability adopted by Li (2008) and using earnings per share as a measure of earnings, the authors found, for a sample composed of firms listed on the US stock market between 2000 and 2012, that firms with greater incentive to manage results to overcome past year's earnings present less readable information.

The relationship between readability and earnings remains valid when using alternative measures of information complexity, and when applied in a setting other than North America. Davis et al. (2012), analyzed a sample of approximately 23,000 quarterly press releases between 1998 and 2003. They constructed optimistic and pessimistic textual language measures and related them to firms' performance as measured by the cumulative abnormal return and the variance of asset returns. The results demonstrated that optimistic language levels are predictive of the firms' performance in future quarters. Ajina et al. (2016) in their study conducted on the French stock market between 2010 and 2013 with 163 firms, assessed the readability of the annual reports using the Fog index, earnings management through discretionary accruals and the earnings calculated as the net profit scaled by total assets. The findings show that firms performing profit management tend to present less readability of their annual reports. This relationship was also identified for the measure of earnings, so that firms with lower earnings in the analyzed period had less intelligible information.

In addition, driven by the resumption of research on understanding narrative accounting disclosures, empirical and theoretical research show, in addition to the relationship between readability and earnings, the complex financial statements: are considered more expensive for some investors, resulting in reduction of commercial activities (Miller, 2010); reduce the extent to which prices establish information (Callen et al., 2013); result in greater dispersion of analysts' forecasts (De Franco et al., 2015; Lehavy et al., 2011) and; are mitigated by alternative channels of disclosure (Guay et al., 2016).

Given that the usefulness of information depends on the complexity of the written material and on the user's knowledge about the processes (allowing to interpret the adequate meanings), and considering that less readable reports adversely affect the environment of information, it is an empirical matter to test the possible effects of the low readability of the narrative accounting disclosures in the stock market.

2.2. Management obfuscation hypothesis and variations of ontology

One understanding of complex narrative accounting disclosures is that they outsource an information-based agency problem. Managers can intentionally add complexity to narratives if they have personal benefits (Guay et al., 2016). This hypothesis is reported in the literature as the management obfuscation hypothesis, where managers have incentives to overshadow information when the firm's performance is unsatisfactory, slowing the market reaction (Bloomfield, 2002). The underlying assumption behind this

reasoning finds support in the incomplete revelation hypothesis: because the analysis of financial information is costly, it only leads to detailed analyzes when the marginal benefit is greater than the marginal cost of later analysis (Bloomfield, 2002; Grossman and Stiglitz, 1980). Hence, complex disclosures reduce the quality of the analysis by increasing the cost of information processing, so managers can expect complex and costly information to make it harder to identify information that can affect stock prices (Li, 2008).

Drake et al., 2016 empirically show that complex information increases processing costs. The authors analyze four scenarios of information search and found that the complexity of the financial statements influences the investors' historical accounting reports, which indicates that the obfuscation of data adds costs to the decision making process.

The manipulation of narrative information to deliberately add complexity is related to the current performance. Firms with weak performance tend to hide this fact through complex information. The assumption for this is that if current earnings are transient, or if unsatisfactory earnings are persistent, managers have incentives to make narrative accounting disclosures harder to read (Li, 2008). Similarly, firms with better current and future performance may disclose less complex information, which would reduce their informational processing costs.

Managers involved in actions that maximize their personal well-being (incentive) or who are trying to reach a benchmark (opportunism), may present complex narrative accounting disclosure. This maximization may be tied to damaging corporate actions, such as earning management through discretionary accruals or real activities (Cohen and Zarowin, 2010; Lo et al., 2017).

Recent studies observed the obfuscation of narrative information in different contexts. Lee (2012), examines whether complex quarterly reports jeopardize the efficiency of the stock market, and show that less readable information harms the market because it delays companies' analyses. Dempsey et al. (2012) found that companies with poor performance regarding return on assets (Roa), release information with a high degree of obfuscation, empirically corroborating the management obfuscation hypothesis for a sample of 1273 firm-year observations for the period 1994 to 1997. Hwang and Kim (2017), found a negative effect for the low readability of the annual report in the companies' market value. According to Ertugrul et al. (2017), the lack of readability of the annual report and the ambiguity of the accounting narratives are harmful to shareholders because these elements add costs in processing the information and result in increased cost of companies' external financing. Laksmana et al. (2012) analyzed the obfuscation from the point of view of the personal welfare and identified that companies that pay Chief Executive Officers (CEOs) compensation that is not linked with economic determinants add complexity in the release of the "Compensation Discussion and Analysis" narrative. The authors show that obfuscation may be connected to the maximization of the CEOs' welfare. These studies use, in general, readability measures as a proxy for obfuscation, and the results show that management obfuscation is used both due to incentives and opportunistically.

Adopting a different perspective about the management obfuscation hypothesis, Bloomfield (2008), discussing the results of the research by Li (2008), offers alternative paths for the relationship between readability and firms' performance. This alternative view is the hypothesis of variations of ontology. From the standpoint of ontological explanations, less readable narrative accounting disclosures reflect the complexity of business transactions as well as disclosure rules. Bloomfield (2008) also reports that losses need to be better explained. Given that the objective of firms is not to present losses, these "exceptions" should be better presented to the market, which can lead to more extensive and sometimes more complex information. Another explanation is that due to the character of accounting conservatism, acknowledging negative news in a more careful way than the positive, it is harder to communicate negative news. These ontological elucidations demonstrate that readability is closely tied to the momentary situations of firms in the context of the preparation of accounting information.

For Rutherford (2016), the research that seek to validate the management obfuscation hypothesis fail to interpret the concept of readability, and also in attributing their findings to formulas that are not adapted to the business content. The author's criticism indirectly supports the hypothesis of variations of ontology. Stone and Parker (2016), discuss the criticisms Rutherford (2016), arguing that research projects on accounting communication should follow a multimethod procedure in which other readability complementary measures are used as a proxy to assess complexity as they bring explanatory value to current studies. Bushee et al. (2018) offer practical alternatives to the debate, based on the assumption that complex language may be a result of management obfuscation or an intrinsical function of the information, and related to the informational asymmetry. Using a sample formed by transcriptions of quarterly teleconferences held between 2002 and 2011, the authors' results corroborated the argument that information (obfuscation) is associated with a lower (higher) information asymmetry.

In agreement with the concerns that the complexity of accounting information may be the result of the management obfuscation hypothesis, and the high levels of complexity reflect a deliberate choice, it seems unlikely that in environments with low legal protection, such as in this research, managers feel inclined to increase the quality of accounting information. Thus, this study takes as alternative hypothesis the management obfuscation hypothesis (low readability is an externalization of the agency problem) and the null hypothesis the one of variations of ontology (readability is inherently a function of circumstances).

3. Methodology

3.1. Data selection and sample treatment

To test the hypothesis of the study a main sample was composed of Brazilian firms, listed on the B3 stock exchange, with data available between the years 2010–2016.

International research on the comprehension of narratives through readability proxies, calculate them using, as a matter of

priority, the explanatory notes or the section of the annual report called “Management Discussion and Analysis (MD&A)”. Merkl-Davies and Brennan (2007) suggest that readability research are grouped into four categories: (i) difficulty in reading narrative accounting disclosure; (ii) variation of readability of different narrative sections of the annual reports; (iii) studying the characteristics of the firm and readability of narrative accounting disclosures; and (iv) studies focused on methodological issues.

This research fits category (ii) as presented by Merkl-Davies and Brennan (2007), since a specific section of the reference form (RF) will be analyzed. To form the sample, the information for readability proxies was manually extracted from section 10.1 of the RF by firm for each year of the sample. The RF was chosen after the content analysis of all sections of item 10 “Directors’ comments”, as it is considered the most informative among the sections that relate to the firms’ results. In addition, RF can be compared to MD&A in terms of information offered.

The RF was introduced by the instruction of the Securities and Exchange Commission of Brazil nº 480 of (2009) and requests information regarding risk factors, firms’ management, the structure of capital, and comments from the board of directors. These elements offer investors an overview of the quality of the firms’ management related to internal, external, legal and technical risks. The starting year (2010) is the first year that information was registered on the reference form in a standardized way.

The choice for the research environment is: (i) to respond to Li (2010), and Merkl-Davies (2007) suggestion for further research analyzing the complexity of narrative information in non-English environments; (ii) because of the exogenous informational factor originated in 2010 with the introduction of the RF; (iii) due to the fact that Brazil is a country with a concentrated property structure offering low protection to minority shareholders, which may encourage the use of deliberately complex information narratives; and (iv) because this is a scenario that is not mainstream, which contributes to clarify the criticisms raised by Rutherford (2016) about the researchers “fabrication” of the obfuscation of accounting narratives.

After collecting the RF information, the financial information obtained from the Economatica® database was collected. In the process of forming the sample, firms from the financial sector and related areas were initially excluded due to structural, operational and financial differences (Healy and Wahlen, 1999). Subsequently, firms with missing data to calculate the variables were excluded. Finally, outliers were excluded. Considering that the discrepant values may make the results biased, the values according to the Z score formula (Levine et al., 2016) were considered outliers, which is the relation between the difference of the value of the data and the sample mean with the standard deviation of the sample.

To test the possibility of the dependent variables (readability measures) having an explanatory characteristic, a secondary sample was formed from these lagged measures in one period, based on the main sample. The underlying idea of this procedure was to verify if the understanding of the narrative accounting disclosures of year t_0 impacts on the investors’ judgment, reflecting in the financial performance of the firms in t_1.

After the adjustments the main sample was 1643 and the secondary sample was 1297 firm-years, both composing an unbalanced panel. Table 1 summarizes the sample selection and treatment procedure.

3.2. Theoretical and operational definition of variables

3.2.1. Dependent variables

The readability measures were elaborated through the concept of duration of information. Three readability proxies were calculated: the natural logarithm of the archive’s size, the natural logarithm of the number of words and the number of pages of the document.

The first variable is the natural logarithm of the total archive’s size in Microsoft Word. This variable was proposed by Loughran and McDonald (2014) as a simple proxy for readability. The goal of the measure is to capture whether both narrative and visual information interfere with the analysis of information. Bonsall et al. (2017) warn that a great variability for this measure can be boosted by the inclusion of content unrelated to the underlying text, thus suggesting the exclusion of such contents in the operationalization of the variable. This observation was circumvented by the use of the second variable.

The second variable is the natural logarithm of the number of words. Li (2008) introduced the use of this variable in the context of the management obfuscation hypothesis, understanding that longer documents may be used to lead the reader in assessing the firm.

The third variable is the number of pages. Used in other contexts of accounting research (for example, Cho et al. (2014)), this variable is used as a measure of the quantity of information and can be understood as a proxy for readability because it is related to the concept of information’s duration.

Table 1
Sample Selection and Treatment.
Source: Elaborated with research data.

Sample Selection	Main sample	Secondary sample
All Economática® companies for the years 2010–2016	4515	
Less: companies belonging to the financial sector and related	854	
Less: companies with insufficient data to calculate the variables	1786	
Less: companies considered outliers {rule: -3 > Z score > +3}	232	
Less: companies with missing lagged readability variables	do not apply	346
Final sample (firm-years)	1643	1297

In order to operationalize the variables, the firms' reference form was downloaded from the B3 website, with the subsequent selection of section 10.1. For the measurement of the variable "ln.archive" the totality was considered in kbites of section 10.1 in Microsoft Word, as suggested by Loughran and McDonald (2014). In order to circumvent possible biases in the text content, the variable "ln.words" was calculated considering only the words related to content in form of text, disregarding content in tables and charts, as suggested by Bonsall et al. (2017). The third variable is the number of pages covered by section 10.1.

The choice of readability proxies observes the criticism by Curto and dos (2014), that the most popular linguistic formulas derived from computational linguistics were developed for writing in English.

3.2.2. Variables of interest

To test the management obfuscation hypothesis, measures of profitability were used. The idea is that managers deliberately provide complex financial information in narrative accounting disclosures when performance is poor or earnings are transient, so low-readability hides negative news (Bloomfield, 2002, 2008; Clatworthy and Jones, 2001; Rutherford, 2005).

As a proxy for earnings, financial performance accounting measures were used: return on assets (Roa), earnings per share (Eps) and binary variable to indicate the direction of earnings per share (d.Eps). A negative relationship between these measures and the readability variables is expected, suggesting that, when outcomes are unfavorable, managers tend to provide complex information in the narratives (Ajina et al., 2016; Davis et al., 2012; Li, 2008; Lo et al., 2017).

Roa is calculated as the ratio of net income and total assets. The Eps is the result of the period (positive or negative) divided by the total shares of the firm. The variable d.Eps is a binary that assumes the value 1 (one), if the firms present positive value for variable Eps and 0 (zero) otherwise.

3.2.3. Variables of control

To avoid biased results, we included control variables that may affect the relationship between readability and earnings. These variables are considered as non-strategic components. Factors examined include measures of leverage, size, age of firms and sectorial classification.

3.2.4. Leverage

Firms with a high level of debt may have to persuade capital providers to invest, thereby disclosing more complex information. A positive sign is expected for leverage measure when it is related to readability, as in the research by Ajina et al. (2016). The sum of current and non-current liabilities scaled by total assets was used as a measure of leverage.

3.2.5. Firm size

The firm size may influence their financial statements making them more complex. This complexity can be reflected in the size of narrative accounting disclosures (Ajina et al., 2016; Li, 2008; Lo et al., 2017). Thus, the expected signal for this variable is positive. The natural logarithm of the total asset was used as a proxy for size.

3.2.6. Firm age

Firms that have been active for longer can present more comprehensible narrative accounting reports due to the existence of less information asymmetry and information uncertainty (Li, 2008; Lo et al., 2017). Thus, the expected result for this variable is negative. Age is calculated as the natural logarithm of the difference, in days, from the closing date of the financial statements per year compared to the date of the firms' incorporation.

3.2.7. Sectoral classification

The relationship between readability and earnings was controlled by the firm sector, as in the research by Li (2008). For this purpose, the sectoral division used by the Economática® database was the reference to classify firms into twenty sectors. Due to the exclusion of the financial sector, the sample was segregated in nineteen sectors. In order to operationalize the variable, the binary procedure was adopted, and a sector "other" was considered as a reference. Thus, eighteen binary variables were used.

3.3. Analysis models and techniques

To understand the relationship between readability and earnings established in the literature, the following relation was proposed to test the hypothesis of the study:

$$\text{Readability} = f(\text{Profitability},\ \text{Control Variables}) \tag{1}$$

The empirical test of this relation was given by the following econometric model:

$$(\text{ln.archive; ln. words;pages})_{it} = \beta_0 + \beta_1 \text{Roa}_{it} + \beta_2 \text{Eps}_{it} + \beta_3\, \text{d. Eps}_{it} + \beta_4 \text{Lev}_{it} + \beta_5 \text{Size}_{it} + \beta_6 \text{Age}_{it} + \text{Sector}_{n-1it} + \mu_{it} \tag{2}$$

Initially, the parameters for model 2 were estimated with the natural logarithm of the size in kbites of item 10.1 of the RF, in order to verify if both the narrative and the visual information are affected by the earnings of the firm. In a second moment, the parameters

of model 2 were re-estimated using, as a dependent variable, the natural logarithm of the number of words of item 10.1 of the RF. This procedure aimed to capture the effect of the writing form on the relationship between readability and earnings. Finally, model 2 was re-evaluated, having, as dependent variable, the number of pages of item 10.1 of RF. Analogous to previous interpretations, it is expected that the measures of earnings will influence the readability of the narratives.

Due to the possibility of model 2 dependent variables presenting explanatory characteristics, readability measures were regressed against the overall measure of financial performance, originating the following econometric model:

$$\text{Roa}_{it} = \gamma_0 + \gamma_1(\text{ln. archive; ln. words; pages})_{it-1} + \gamma_2\text{Lev}_{it} + \gamma_3\text{Size}_{it} + \gamma_4\text{Age}_{it} + \text{Sector}_{n-1it} + \phi_{it} \quad (3)$$

Model 3 was estimated with the secondary sample of the research and, similarly to model 2, re-estimates were performed for each measure of readability lagged in one period. The underlying idea of the model is to identify the possible effects of the persistence of complex information on the firm's performance. The market is expected to penalize firms with complex past reports. The statistical evidence of this phenomenon will corroborate the management obfuscation hypothesis.

Given the characteristics of the sample, models 2 and 3 were estimated by the panel data technique, since longitudinal regression models provide: greater amount of information, greater variability of data, less multicollinearity among regressors, greater degrees of freedom, and greater efficiency of the parameter estimation (Marques, 2000).

The estimators for the panel data technique were defined by means of appropriate analyzes. For model 2 when using the dependent variables 'ln.archive' and 'ln.words', the random effects estimation by generalized least squares was used. The choice for this estimator was due to non-variation of firms by sector of the sample, which made it impossible to use fixed effects. This procedure was also used when estimating the parameters of model 3.

To estimate model 2 using the dependent variable 'pages', the regression procedure for count data was adopted. The Poisson and negative binomial models are part of the set of models that analyze the behavior of dependent variables with discrete and non-negative values (Fávero and Belfiore, 2017). The first requires that the counting variable has an average equal to the variance, otherwise the negative binomial regression model must be used due to the existence of overdispersion of the dependent variable. The research data present features of overdispersion for variable 'pages', so we chose to estimate the negative binomial regression model. This is inserted in the context of generalized linear models.

To validate the research the following decision rules were adopted. The management obfuscation hypothesis is supported if β_1, β_2 and β_3 are negative and statistically significant for estimations of model 2. This generally indicates that firms with lower earnings tend to overshadow narratives through more complex information. The management obfuscation hypothesis is corroborated if γ_1 is positive and statistically significant for model 3 estimates, which will show evidence that less complex past information is recognized by the market.

Table 2
Descriptive statistics – full sample by year.
Source: Elaborated with research data.

	2010		2011		2012		2013		2014		2015		2016	
Variables	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std
ln.archive	3.6	0.8	3.5	0.8	3.7	0.8	3.8	0.9	3.8	0.9	3.9	0.9	3.9	0.9
ln.words	8.2	1.0	8.1	0.9	8.3	1.0	8.5	1.0	8.5	1.0	8.5	1.0	8.6	0.9
pages	13.7	10.8	12.6	9.6	14.8	10.7	16.9	12.0	17.3	12.0	18.2	12.8	17.9	11.7
Roa	0.1	0.1	0.0	0.1	0.0	0.2	0.0	0.3	0.0	0.4	−0.1	1.0	0.0	0.6
Eps	3.2	87.7	−4.5	186.5	−12.1	318.2	−10.7	112.9	−4.3	110.3	−4.1	40.9	−7.7	89.4
Lev	0.6	0.3	0.6	0.3	0.6	0.4	0.6	0.5	0.6	0.8	0.7	0.7	0.8	0.9
Size	21.1	1.7	21.2	2.1	21.2	2.2	21.2	2.1	21.4	2.1	21.3	2.1	21.2	2.2
Age	9.2	1.0	9.2	0.9	9.2	0.9	9.3	0.9	9.3	0.8	9.3	0.8	9.4	0.8

	2010		2011		2012		2013		2014		2015		2016	
Variables	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
ln.archive	2.1	6.2	2.1	6.2	2.1	6.3	2.2	6.2	2.2	6.4	2.3	6.3	2.3	6.2
ln.words	5.2	10.3	5.1	10.1	5.0	10.3	5.9	10.5	5.7	10.3	5.8	10.2	5.8	10.1
pages	1.0	58.0	1.0	53.0	1.0	49.0	2.0	58.0	2.0	54.0	1.0	57.0	1.0	56.0
Roa	−0.4	0.5	−0.4	0.4	−1.7	0.9	−3.2	0.5	−6.1	0.2	−15.3	0.3	−8.3	2.2
Eps	−767	716	−2.529	884	−4.820	914	−1.203	583	−1.279	757	−313	355	−919	414
Lev	0.0	2.4	0.0	2.7	0.0	3.6	0.0	4.0	0.0	12.3	0.0	6.3	0.0	9.3
Size	15.9	27.0	12.9	27.1	12.4	27.2	12.1	27.3	12.7	27.4	13.1	27.5	13.0	27.4
Age	6.7	10.8	6.8	10.8	6.9	10.8	7.2	10.9	6.9	10.9	7.2	10.9	6.7	10.9

Variables are defined in Appendix A.

Table 3
Occurrence and frequency of earnings per share: variable d.Eps.
Source: Elaborated with research data.

Earnings per share	Year	Yes	No	Total
Count	2010	160	27	187
Percentage (%)		85.6	14.4	100
Count	2011	171	58	229
Percentage (%)		74.7	25.3	100
Count	2012	174	74	248
Percentage (%)		70.2	29.8	100
Count	2013	178	71	249
Percentage (%)		71.5	28.5	100
Count	2014	174	77	251
Percentage (%)		69.3	30.7	100
Count	2015	152	95	247
Percentage (%)		61.5	38.5	100
Count	2016	146	86	232
Percentage (%)		62.9	37.1	100
Count	Total	1155	488	1643
Percentage (%)		70.3	29.7	100

4. Results analysis

4.1. Descriptive statistics and association analysis

Table 2 shows the descriptive statistics for the main sample after the exclusion of the discrepant values. The statistics shown are: arithmetic mean (Mean), standard deviation (Std), minimum (Min) and maximum (Max) values, for all firms per year.

The readability measures increase from the year 2013. The oscillations of the dispersion measures are more sensitive in the variable 'pages', as it is a counting variable. The 'ln.archive' and 'ln.words' measures present smaller variations between their extreme points and also smaller variance in relation to the average, confirming the correctness in the decision to exclude outliers. The accentuation of the complexity evidenced by the increase of the averages for readability proxies are in agreement with the international findings (Bonsall et al., 2017; Li, 2008; Lo et al., 2017).

The measure of earnings Roa presents a negative average for the year 2015, which may increase the disclosure of complex information in this period. The variable Eps is negative over the years, except for the year 2010. These negative average results are associated with the size of the minimum values for the variable that are smaller than their maximum peers in all analyzed years. This scenario of negative results may encourage managers to deliberately disclose more complex narratives to obscure persistent poor performance.

The control variables presented statistical dispersion of data and extreme values in acceptable parameters, indicating that these variables present homogeneity characteristics, so they are considered the correct choice.

Table 3 shows the number of firms with a profit per share. This information is captured by the variable d.Eps which assumes the value 1 (one) if the firm shows a profit per share and 0 (zero) otherwise.

From Table 3 it is possible to identify that, for every year, earnings per share are predominant. In 70.3% of the firms, this characteristic was observed.

Table 4
Correlation between selected variables.
Source: Elaborated with research data.

	1.ln.archive	2.ln.words	3.pages	4.Roa	5.Eps	6.d.Eps	7.Lev	8.Size	9.Age
1	1	0.749***	0.773***	0.007	0.008	0.051**	0.114***	0.445***	−0.129***
2	0.659***	1	0.962***	0.051**	0.028	0.086***	0.084***	0.560***	−0.253***
3	0.626***	0.858***	1	0.038	0.021	0.081***	0.080***	0.527***	−0.231***
4	0.029	0.042*	0.048*	1	0.778***	0.792***	−0.307***	0.078***	0.008
5	−0.044*	−0.055**	−0.052**	0.073***	1	0.792***	−0.241***	0.122***	0.105***
6	0.030	0.075***	0.087***	0.260***	0.164***	1	−0.270***	0.148***	0.040
7	0.011	−0.026	−0.017	−0.271***	−0.077***	−0.227***	1	0.123***	0.109***
8	0.389***	0.533***	0.440***	0.202***	−0.016	0.156***	−0.058**	1	−0.121
9	−0.100***	−0.226***	−0.187***	0.061***	0.012	0.050**	0.034	−0.025	1

*, **, *** indicates statistical significance at the levels of 0.10, 0.05 and 0.01, respectively.
Variables are defined in Appendix A.
In the lower diagonal the coefficients for the Pearson correlation are presented and in the upper diagonal the coefficients for the Spearman correlation are presented.

Table 5
Estimates to capture the readability and profitability ratio.
Source: Elaborated with research data.

Dep. Var.	ln.arquive			ln.words			pages		
	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value
Roa_{it}	−0.053	0.030	0.072*	−0.060	0.024	0.011**	−0.045	0.023	0.044**
Eps_{it}	−0.0002	0.0001	0.052*	−0.0002	0.0001	0.054*	−0.0001	0.0001	0.011**
$d.\ Eps_{it}$	−0.064	0.038	0.091*	−0.072	0.031	0.020**	−0.030	0.026	0.253
Lev_{it}	0.060	0.029	0.036**	0.069	0.024	0.003***	0.074	0.022	0.001***
$Size_{it}$	0.170	0.017	0.000***	0.250	0.018	0.000***	0.173	0.015	0.000***
Age_{it}	0.064	0.044	0.141	0.027	0.046	0.559	0.046	0.037	0.216
$Const_{it}$	−0.324	0.525	0.538	3.044	0.536	0.000***	−0.926	0.435	0.033**
Sector	Yes			Yes			Yes		
Obs	1643			1643			1643		
R^2	whithin	between	overall	whithin	between	overall	Log likelihood$_0$		−5274
	0.039	0.242	0.179	0.064	0.351	0.326	Log likelihood$_{Máx}$		−5189
Test B-P	1293.81 0.000***			2034.42 0.000***			Test for overdispersion		0.283
									0.000***
							Random vs Pooled		1141
									0.000***

*, **, *** indicates statistical significance at the levels of 0.10, 0.05 and 0.01, respectively.
Variables are defined in Appendix A.
Coef. is the abbreviation for Coefficient. S. E. is short for Standard-Error. Const. is the abbreviation for constant. Obs is the abbreviation for observations. R^2 e Log-likelihood they measure quality-adjusted. B–P is the Lagrange multiplier of Breusch-Pagan testing where H0: POLS model and H1 model random effects. Based on the B–P test rejected the null hypothesis (coef. 1293.81, $p < 0.01$ and coef. 2034.42, $p < 0.01$, for the model with dependents variables ln.arquive e ln.words, respectively). The test for overdispersion in the Poisson model is proposed by Cameron and Trivedi (1990). The decision rule is that: if beta is statistically different from zero, what happened (coef. 0.283, $p < 0.01$), we can conclude that the data of the dependent variable are overdispersed, making the negative binomial regression model the most appropriate. The test Random vs Pooled has as hypotheses: H0: Pooled model and H1: model random effects. Based on the test we can reject the hypothesis that the negative binomial Pooled model provides apprpriate estimates (coef. 1,141, $p < 0.01$).

In a joint analysis of the information in Table 3 with the descriptive statistics of the variable Eps in Table 2, it is possible to say that the negative values are higher than the positive values, which can boost the complexity of the narratives.

Table 4 presents the Pearson correlation matrix on the lower diagonal and the Spearman correlation matrix on the upper diagonal. The coefficients of the correlations between the dependent and the independent variables are in acceptable parameters (less than 0.8 according to Gujarati and Porter (2011)). The coefficients are not considered high when compared with the relationship observed between the independent variables. This suggests that there are no data multicollinearity problems.

Analyzing the relationship between readability and earnings results in finding out an ambiguous relationship. Roa and d.Eps measures are positively related to readability measures. The variable Eps indicates a negative relation. This ambiguous evidence supports the application of more robust analyzes to identify the real direction of the signals in the relationship between readability and earnings.

4.2. Econometric analysis of the relationship between readability and profitability

Table 5 shows the results of the estimates of model 2, having as dependent variables the size in kbites of item 10.1 of RF, the number of words in these archives, excluding those present in tables and the number of pages that comprise the item 10.1 of the RF.

According to the management obfuscation hypothesis in the study by Bloomfield (2002), the variables of earnings are negatively related to readability. Specifically, the coefficient for the overall financial performance measure Roa is negative and significant for all model 2 specifications (coef. -0.053, $p < 0.10$, coef. -0.060, $p < 0.05$ and coef. -0.045, $p < 0.05$). Findings for earnings per share are also similar (Eps, coef. -0.0002, $p < 0.10$, coef. -0.0002, $p < 0.10$ and coef. -0.0001, $p < 0.05$). This means that in the face of poor performance, managers deliberately present the narrative accounting disclosures in a more complex way. This complexity makes information for decision making more difficult to extract, so that lack of readability is considered a subterfuge for managers to overshadow information. These findings are corroborated with the finding for variable d.Eps, which is negatively related to the dependent variables 'ln.archive' and 'ln.words' (coef. -0.064, $p < 0.10$ and – 0.072, $p < 0.05$, respectively). Particularly for this variable, it is observed that when earnings per share is present, the narrative accounting disclosures are considered less complex.

The findings for association between readability and earnings support the management obfuscation hypothesis, that the low readability is an externalization of the agency problem, being consistent with the international evidence found by Ajina et al. (2016); Davis et al. (2012); Li (2008) and Lo et al. (2017).

Table 6
Estimates to capture effect of the persistence of readability in overall financial performance.
Source: Elaborated with research data.

	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value
$ln.\ archive_{it-1}$	−0.037	0.019	0.058*						
$ln.\ words_{it-1}$				−0.052	0.019	0.005***			
$pages_{it-1}$							−0.002	0.002	0.176
Lev_{it}	−0.232	0.024	0.000***	−0.231	0.024	0.000***	−0.233	0.024	0.000***
$Size_{it}$	0.059	0.008	0.000***	0.067	0.009	0.000***	0.058	0.009	0.000***
Age_{it}	0.048	0.020	0.017**	0.038	0.020	0.062*	0.047	0.020	0.021**
$Const_{it}$	−1.394	0.244	0.000***	−1.176	0.261	0.000***	−1.470	0.245	0.000***
Sector	Yes			Yes			Yes		
Obs	1297			1297			1297		
R^2	within	between	overall	within	between	overall	within	between	overall
	0.076	0.349	0.160	0.080	0.347	0.163	0.075	0.346	0.159
Test B-P	[1.20] 0.137			[1.17] 0.140			[1.29] 0.128		

*, **, *** indicates statistical significance at the levels of 0.10, 0.05 and 0.01, respectively.
Variables are defined in Appendix A.
Coef. is the abbreviation for Coefficient. S. E. is short for Standard-Error. Const. is the abbreviation for constant. Obs is the abbreviation for observations. R^2 e Log-likelihood they measure quality-adjusted. B–P is the Lagrange multiplier of Breusch-Pagan testing where H0: POLS model and H1 model random effects. Based on the B–P test not possible to reject the null hypothesis (coef. 1.20, p = 0.00, coef. 1.17, p = 0.00, and coef. 1.29, p = 0.00, for the model with dependents variables ln.arquive, ln.words and pages, respectively). The robust POLS models were estimated and are presented in Appendix B, being that no significant changes in the analyzes was detected.

Regarding the control variables, the measure of indebtedness is positive and statistically significant when explaining the dependent variables (Lev, coef. 0.060, p < 0.05, coef. 0.069, p < 0.01 and coef. 0.074, p < 0.01). This suggests that firms that are more leveraged, are liable to make the narrative accounting disclosure less intelligible. In this way, it can be said that firms with a high level of debt tend to persuade capital providers to invest, by providing more complex information, which is confirmed by Ajina et al. (2016).

The measure that captures the size of the firms has a positive and significant relationship with readability proxies (Size, coef. 0.170, p < 0.01, coef. 0.250, p < 0.01 and coef. 0.173, p < 0.01). Thus, larger firms are more likely to deliver complex narrative accounting disclosure, due to the complexity of their operating and financial activities in the financial statements. This finding is in agreement with the research by Li (2008) and Ajina et al. (2016).

In order to analyze if the market recognizes the persistence of complex narrative accounting disclosure, the parameters of model 3 were estimated. Table 6 presents the results of the model 3 estimates, having readability measures lagged in one period as interest variables. The underlying idea of this analysis is to check whether previous complex information interferes with the current analysis of the firm.

The results indicate that previous complex information negatively impacts the current firms' performance. The coefficients for 'ln.archive' and 'ln.words' are negative and statistically significant (coef. -0.037, p < 0.10 and; coef. -0.052, p < 0.01, respectively). These results provide indications that the market recognizes complex information as harmful.

The results corroborate the management obfuscation hypothesis and may be associated with the incomplete revelation hypothesis, where the analysis of the financial information is expensive and leads to detailed analysis only if the benefits of this analysis are greater than its costs (Bloomfield, 2002; Grossman and Stiglitz, 1980). In this way, less intelligible disclosures reduce the quality of the analysis due to the possibility of increasing the cost of information processing.

4.3. Additional analyses

Seeking to minimize econometric problems, the parameters of the models were re-estimated, taking into consideration robust standard-errors, technique to detect multivariate outliers and alternative methods to estimate the data count model. The re-estimated values for model 2 are presented in Panel A and the re-estimated values for model 3 are in Panel B in Table 7.

4.3.1. Robust standard errors clustered at the firm level

The application of the standard-errors technique helps to choose the best estimator for the model. Regressions correcting standard-errors by clustering at the firm level were conducted as proposed by Cameron and Trivedi (2009).

Based on Panel A in Table 7 it is possible to observe that the results for the variable Roa are stable in terms of statistical significance and expected signal when the determinants of the readability measures are ln.arquive and ln.words (coef. -0.053, p < 0.10 and coef. -0.060, p < 0.01, respectively), which corroborates previous findings supporting the management obfuscation hypothesis. The variable Eps confirmed to be explanatory of the measure ln.words (coef. -0.0002, p < 0.01), but it did not explain the dependent variable ln.arquive. As for the measure d.Eps, it was negative both for the dependent variable ln.arquive and the variable ln.words. It was significant, however, only for the variable ln.words (coef. -0.072, p < 0.10).

Table 7
Robustness tests considering robusts standard-erros, technique to detect multivariate outliers and Poisson regression model.
Source: Elaborated with research data.

Painel A: Robustness test for dependent variables

	Dependent variable: ln.arquive						Dependent variable: ln.words						Dependent variable: pages					
	Clustered id			Outliers BACON			Clustered id			Outliers BACON			Poisson			Outliers BACON		
	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value
Roa_{it}	−0.053	0.029	0.071*	−0.462	0.198	0.020**	−0.060	0.022	0.005***	−0.264	0.164	0.107	−0.044	0.018	0.018**	−0.381	0.156	0.015**
Eps_{it}	−0.0002	0.000	0.217	0.0003	0.001	0.823	−0.0002	0.000	0.006***	−0.001	0.001	0.303	−0.0001	0.000	0.001***	0.001	0.001	0.508
$dEps_{it}$	−0.064	0.040	0.114	−0.024	0.045	0.594	−0.072	0.038	0.060*	−0.031	0.036	0.399	−0.020	0.020	0.323	0.0002	0.031	0.995
Lev_{it}	0.060	0.026	0.020**	0.016	0.053	0.766	0.069	0.042	0.098*	0.120	0.044	0.007***	0.078	0.018	0.000***	0.060	0.038	0.113
$Size_{it}$	0.170	0.017	0.000***	0.177	0.018	0.000***	0.250	0.024	0.000***	0.267	0.019	0.000***	0.190	0.014	0.000***	0.183	0.016	0.000***
Age_{it}	0.064	0.045	0.156	0.067	0.044	0.130	0.027	0.054	0.623	0.009	0.046	0.841	0.136	0.036	0.000***	0.032	0.037	0.393
$Const_{it}$	−0.324	0.553	0.558	−0.490	0.531	0.356	3.044	0.697	0.000***	2.787	0.545	0.000***	−2.331	0.395	0.000***	−1.059	0.441	0.016**
Sector	Yes			Yes			Yes			Yes			Yes			Yes		
Obs	1643			1570			1643			1570			1643			1,570		
R^2	within	between	overall	within	between	overall	within	between	overall	within	between	overall						
	0.039	0.242	0.179	0.042	0.243	0.177	0.064	0.351	0.326	0.074	0.354	0.3324						
											Log-likelihood$_0$		−5,459			−5,192		
											Log-likelihood$_{Máx}$		−5,318			−4,984		
Test B-P	[1293.81]	0.000***		[1271.26]	0.000***		[2034.42]	0.000***		[1918.59]	0.000***		Test for overdispersion			[0.285]	0.000***	
													Random vs Pooled			[1083]	0.000***	

Painel B: Robustness test for Roa

	Clustered id			Outliers BACON			Clustered id			Outliers BACON			Clustered id			Outliers BACON		
	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value
$ln.\ arquive_{it-1}$	−0.037	0.018	0.046**	−0.013	0.005	0.007***												
$ln.\ words_{it-1}$							−0.052	0.028	0.065*	−0.016	0.005	0.002***						
$pages_{it-1}$													−0.002	0.002	0.188	−0.001	0.0004	0.033**
Lev_{it}	−0.232	0.089	0.009***	−0.084	0.010	0.000***	−0.231	0.088	0.009***	−0.083	0.010	0.000***	−0.233	0.089	0.009***	−0.084	0.010	0.000***
$Size_{it}$	0.059	0.023	0.009***	0.017	0.003	0.000***	0.067	0.027	0.012**	0.019	0.003	0.000***	0.058	0.023	0.013**	0.017	0.003	0.000***
Age_{it}	0.048	0.016	0.002***	0.008	0.008	0.279	0.038	0.016	0.020**	0.005	0.008	0.474	0.047	0.016	0.004***	0.007	0.008	0.345
$Const_{it}$	−1.394	0.452	0.002***	−0.319	0.090	0.000***	−1.176	0.355	0.001***	−0.252	0.093	0.007***	−1,470	0.488	0.003***	−0.347	0.091	0.000***

(*continued on next page*)

Table 7 (*continued*)

Painel B: Robustness test for Roa

	Clustered id			Outliers BACON			Clustered id			Outliers BACON			Clustered id			Outliers BACON		
	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value
Obs	1297			1269			1297			1269			1297			1269		
R^2	within	between	overall	within	between	overall	within	between	overall	within	between	overall	within	between	overall	within	between	overall
	0.076	0.349	0.160	0.036	0.322	0.190	0.080	0.347	0.163	0.039	0.319	0.186	0.075	0.346	0.159	0.035	0.316	0.183
Test B-P	[1.20] 0.137			[174.41] 0.000***			[1.17] 0.140			[174.85] 0.000***			[1.29] 0.128			[170.29] 0.000***		

*, **, *** indicates statistical significance at the levels of 0.10, 0.05 and 0.01, respectively.

Variables are defined in Appendix A.

Coef. is the abbreviation for Coefficient. S. E. is short for Standard-Error. Const. is the abbreviation for constant. Obs is the abbreviation for observations. R^2 e Log-likelihood they measure quality-adjusted. B–P is the Lagrange multiplier of Breusch-Pagan testing where H0: POLS model and H1 model random effects. The test for overdispersion in the Poisson model is proposed by Cameron and Trivedi (1990). The test Random vs Pooled has as hypotheses: H0: POLS model and H1: model random effects.

Interpretations for Panel A:

Based on the B–P test rejected the null hypothesis (coef. 1293.81, $p < 0.01$ and coef. 2034.42, $p < 0.01$, for the model with full sample and with the dependents variables ln.arquive and ln.words, respectively, and coef. 1271.26, $p < 0.01$ and coef. 1918.59, $p < 0.01$, for the model with sample without multivariate outliers and with the dependents variables ln.arquive and ln.words, respectively). Based on test for overdispersion (coef. 0.285, $p < 0.01$) we can conclude that the data of the dependent variable are overdispersed, making the negative binomial regression model the most appropriate.Based on test Random vs Pooled we can reject the hypothesis that the negative binomial Pooled model provides apprpriate estimates (coef. 1083, $p < 0.01$).

Interpretations for Panel B:

Based on the B–P test not possible to reject the null hypothesis (coef. 1.20, $p = 0.00$, coef. 1.17, $p = 0.00$, and coef. 1.29, $p = 0.00$, for the model with dependents variables ln.arquive, ln.words and pages, respectively). The robust POLS models were estimated and are presented in Appendix B, being that no significant changes in the analyzes was detected. In addition, the test rejected the null hypothesis for the model with sample without multivariate outliers (coef. 174.41, $p < 0.01$, coef. 174.85, $p < 0.01$ and coef. 170.29, $p < 0.01$, for dependents variables ln.archive, ln.wors and pages, respectively).

Panel B in Table 7 shows that the measures of persistence of the results' narratives complexity were stable ($ln.archive_{it-1}$, coef. -0.037, $p < 0.05$ and $ln.words_{it-1}$, coef. -0.052, $p < 0.10$).

When clustered, the results are robust when showing that the overall financial performance influences the readability of the firms. Also, it is possible to confirm that past information considered complex is understood by the participants of the market as harmful.

4.3.2. Detection of multivariate outliers

The Blocked Adaptive Computationally Efficient Outlier (BACON) technique to detect multivariate outliers was developed by Billor et al. (2000), and the details on how to apply it can be found in the work by Weber (2010). The application of the BACON algorithm was carried out for the sample before the exclusion of outliers identified using the technique by Levine et al. (2016). This means that it was applied to the 1875 observations of the main sample and the 1529 observations of the secondary sample. The procedure detected, respectively, 305 and 260 multivariate outliers.

Panel A in Table 7 shows that the variable of interest overall financial performance (Roa) maintained the expected relation being significant with the dependent variable ln.arquive (coef. -0.462, $p < 0.05$), but the measure was not statistically significant when associated with the variable ln.words. The variables Eps and d.Eps did not present statistical significance for all re-estimations. Thus, it is important to be cautious in interpreting the variables. We decided to keep these measures because we consider their marginal effects when analyzing the impact of profitability on readability. It is worthwhile observing that the results in Brazilian firms' shares prices in the stock market oscillate more strongly than in countries with more stable economies such as the USA.

Based on evidence presented in Panel B in Table 7, it is possible to confirm that previous complex information is understood as harmful, showing a negative relation with the firms' current overall financial performance ($ln.archive_{it-1}$, coef. -0.013, $p < 0.01$; $ln.words_{it-1,}$ coef. -0.016, $p < 0.01$; and $pages_{it-1}$, coef. -0.001, $p < 0.05$).

4.3.3. Poisson regression model

Credited to Wedderburn (1974), when the quasi-likelihood theory is elaborated, the Poisson model is characterized by modeling that presents equal variance and conditional average, indicating a heteroscedastic essence (Ramalho and dos, 1996) because the variance depends on the regressors. The super dispersion observed in the model limits its application, which is why it is used here as a complementary method of analysis.

Observing Panel A in Table 7, the standard errors of the variables of interest for estimating the Poisson model are not discrepant, in the same way as the values of the coefficient (Roa, coef. -0.044, $p < 0.05$; Eps, coef. -0.0001, $p < 0.01$, and d.Eps, coef. -0.020, $p = 0$). These findings are stable in relation to the profitability measures, corroborating the idea that the variable overall financial performance better represents the construct of the firm's profitability.

4.4. Discussion

In summary, the empirical results support the management obfuscation hypothesis introduced by Bloomfield (2002). There is evidence that managers intentionally add complexity to narrative accounting disclosures in order to hide information about poor performance. This complexity, measured by the reduction of readability, makes narratives less effective and more costly in the analysis process, accounting for additional costs in information processing. In this way, underperforming firms have incentives to disseminate deliberately complex narrative accounting disclosures, culminating in the externalization of an information-based agency problem.

The results of the research are relevant because they empirically demonstrate that the success in the communication of the accounting message, linked to the level of readability, is present in environments with low legal protection and with shareholding concentration such as the Brazilian stock market. The findings also show the market's ability to recognize complex narratives as harmful. This statement was verified by analyzing the relationship between readability proxies and their impact on overall financial performance.

To validate the results of the research, we used techniques with robust standard errors, detection of multivariate outliers and alternatives for estimation of the data count model. These efforts ensured that the results are stable, particularly for the overall financial performance that proved to be an efficient proxy to measure profitability in surveys that seek to verify management obfuscation hypothesis.

Unlike the current of research on the accounting narratives obfuscation in English and observing developed markets, the results for the Brazilian scenario enrich the literature by showing that information complexity is a global phenomenon. The lack of readability is added to the mechanisms of accounting information distortion, which can increase informational asymmetry. In a more ambitious analysis, it is possible to infer that the obligation of information is not synonymous with information quality. The regulators must see beyond numerical standardization. In Brazil, the law that regulates the RF does not mention the quality of the narratives, thus allowing complex messages to be sent deliberately to the information users.

Even if considered relevant, the results of the research should be analyzed with caution. This is due to the way in which readability is measured and the methodological choices used in the study.

Readability can be calculated using formulas derived from computational linguistics, with the most used measures being Flesch (1948), Fog (Gunning, 1952) and Lix (Björnsson, 1968) (see Jones and Shoemaker (1994) and Loughran and McDonald (2016), for a complete review). It should be noted that these formulas were not used in the research since they were developed for writing in English. Other readability proxies applied in narrative accounting disclosures have also not been explored, such as: the ambiguous tone of writing (Ertugrul et al., 2017; Rogers et al., 2011) and the language considered optimistic and pessimistic (Davis et al., 2012).

The results are limited to the applied methodology. In this study, the scope of analysis was delimited to inferences about a specific part of the reference form, since it was considered more informative after documentary analysis. However, further analysis can be carried out with the full narrative accounting disclosure and also by measuring the variability of readability between the sections of the accounting reports, as shown by Merkl-Davies and Brennan (2007).

5. Conclusion

The demand for accounting and financial information requires a better understanding of the motivation around the elaboration of this documents. Based on the management obfuscation hypothesis, narrative accounting disclosures may be elaborated in a complex way to make information more difficult to extract. In this research it is argued that the language used in the narrative accounting disclosure becomes less intelligible when the performance is considered negative.

In order to test the management obfuscation hypothesis in the Brazilian scenario, the relationship between readability, measure of complexity, and financial performance was investigated. The readability was calculated based on section 10.1 of the reference form, as it is considered the most informative among the sections of item 10 “Directors’ Comments”. For the measuring earnings, the accounting measures of financial performance considered were: return on assets, earnings per share and binary variable to indicate the direction of results by shares. The hypothesis of the study was tested in a main sample composed of 1643 firm-years and a secondary sample of 1297 firm-years, for the period from 2010 to 2016.

The empirical findings support the management obfuscation hypothesis introduced by Bloomfield (2002). The results indicated that firms with lower earnings tend to present less intelligible narrative accounting disclosures. These findings are in line with the idea that managers deliberately send messages deemed complex to the market as a way to hide unsatisfactory performance.

The results were the same when it comes to the possible effects of the persistence of complex information on the overall financial performance of the firm. The evidence for this relationship indicates that previous complex information negatively affects the current performance of firms. This suggests that the market considers, at least at some level, that managers’ language is a reliable indication of a firm’s performance.

The limitations of the study can be recognized as source for possible future research, which can take into consideration aspects such as readability calculated using formulas derived from computational linguistics, and proxies such as ambiguous tone and writing (optimistic and pessimistic). Future research may expand the analysis on other narrative items, such as explanatory notes. Also, it is a promising field of study to associate readability with private benefits such as CEOs’ excessive compensation. Another area yet to be explored is identifying nuances regarding the mandate of executives and relating readability to stakeholders, which could help to explain the management obfuscation encouraged by personal benefits. Finally, the effects of herd behavior can be applied in behavioral finances to corroborate the comprehension of readability in accounting.

Data availability

Data are available from sources identified in the paper.

Declarations of interest

None.

Acknowledgements

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Appendix A. Variable definitions

Variable Name	Variable Description
Dependent Variables	
ln.arquive	Natural logarithm of the totality in kbites of the word of subsection 10.1of the RF.
ln.words	Natural logarithm of the number of words in section 10.1 of the RF disregarding the content in tables and graphs.
pages	Is the number of pages comprised by section 10.1 of the RF.
Variables of Interest	
Roa	It is the return on the asset calculated as the ratio of net income to total assets.
Eps	It is the result of the period (positive or negative) divided by the total shares of the firm.
d.Eps	It is a dummy that assumes the value 1 (one), if the firm presents positive value for variable Eps and 0 (zero) otherwise.
Control Variables	
Lev	Is the firm leverage measure calculated by the sum of current liabilities with non-current liabilities scaled by total assets.
Size	Is the firm size measure calculated as the natural logarithm of the total asset.
Age	Age is calculated as the natural logarithm of the difference, in days, from the date of the closing of the financial statements per year compared to the date of constitution of the firm.
Sector	Variable dummy assuming the value 1 (one) for the sectors of the sample other than the sector "Others".

Appendix B. Robust standard error estimation for POLS

	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value	Coef.	S. E.	p-Value
$ln.\ archive_{it-1}$	−0.037	0.018	0.049**						
$ln.\ words_{it-1}$				−0.052	0.028	0.067*			
$pages_{it-1}$							−0.002	0.002	0.195
Lev_{it}	−0.232	0.088	0.009***	−0.231	0.088	0.009***	−0.233	0.089	0.009***
$Size_{it}$	0.059	0.022	0.009***	0.067	0.027	0.013**	0.058	0.023	0.014**
Age_{it}	0.048	0.016	0.003***	0.038	0.016	0.020**	0.047	0.016	0.004***
$Const_{it}$	−1.386	0.450	0.002***	−1.170	0.354	0.001***	−1.461	0.486	0.003***
Sector	Yes			Yes			Yes		
Obs	1297			1297			1297		
R^2	0.160			0.163			0.159		

Source: Elaborated with research data.

*, **, *** indicates statistical significance at the levels of 0.10, 0.05 and 0.01, respectively.

Variables are defined in Appendix A.

Coef. is the abbreviation for Coefficient. S. E. is short for Standard-Error. Const. is the abbreviation for constant. Obs is the abbreviation for observations. R^2 e Log-likelihood they measure quality-adjusted.

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