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Corporate Financial Disclosure Measurement in the Empirical Accounting Literature: A Review Article

OMAIMA A. G. HASSAN* and
CLAIRE MARSTON

ABSTRACT

This paper develops a framework for corporate financial disclosure measurement to identify and evaluate measures of financial disclosure employed in prior empirical accounting studies. It identifies two approaches: (i) a disclosure-based approach that investigates actual disclosure, operationalizes the concept of disclosure in terms of its main dimensions such as the quantity and quality of disclosure, and develops methods to measure them such as the disclosure index and textual analysis, and (ii) a non-disclosure-based approach that uses the values of some observable variables to proxy for disclosure such as market-based disclosure measures. The study also discusses the extent to which the reliability and validity of these different measures of disclosure are tested. The purposes of this review are: (i) to help future researchers identify exemplars and select or develop their own suitable disclosure measures, and (ii) to identify measurement issues relating to corporate financial disclosure and provide avenues for future research.

Keywords: accounting information; financial disclosure; financial reporting; measurement; reliability; validity.

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1. INTRODUCTION

Corporate financial disclosure¹ is any deliberate release of financial information, whether numerical or qualitative, required or voluntary, via formal or informal channels (Gibbins, Richardson, & Waterhouse, 1990, p. 122). Companies disclose information² through various means such as annual reports, conference calls, interim reports, prospectuses, press releases, and websites. Prior empirical accounting studies have attempted to develop various measures for financial disclosure, but to date there is no comprehensive systematic review that identifies and evaluates these measures. This paper addresses this gap and develops a framework for financial disclosure measurement based on a review of 280 prior empirical studies published in top rated accounting journals.

Financial disclosure is important because it is the primary means of communication between management and outside investors as well as market participants in general. Hence the literature on financial disclosure is enormous and investigates a wide range of issues such as the determinants of voluntary disclosure, the impact of regulatory change on the extent of disclosure, and the economic consequences of disclosure. Although many studies investigate financial disclosure for the private sector companies, others look at the public sector and not-for-profit organizations. In all these studies, disclosure plays a key role and must be measured in some way. However, measuring disclosure is difficult because disclosure is a theoretical construct which is not directly observable.

¹ Some researchers refer to the numbers in the financial statements as “financial reporting”. Other scholars view numbers outside the financial statements and texts as “disclosure”. Others view both these types as financial disclosure (e.g., Gibbins et al., 1990). We belong to the third school and adopt Gibbins et al.’s (1990) definition of corporate financial disclosure, which covers both the numbers in the financial statements and other numbers as well as texts in the disclosure vehicle.

² Corporate disclosure can also be directed to parties other than outside investors, such as stakeholders more generally, strategic investors, and strategic debtholders.

Previous review articles discuss several ways of measuring disclosure, by looking at either one method or one type of disclosure. For example, Marston and Shrivess (1991) concentrate on the disclosure index, whereas Jones and Shoemaker (1994) examine textual analysis techniques. Healy and Palepu (2001) discuss concerns about measuring voluntary disclosure and consider the disadvantages of three measurement proxies: management forecasts, analyst ratings, and self-constructed disclosure indices developed by researchers. They consider that analyst ratings and self-constructed disclosure indices are likely to be noisy³ measures of disclosure.

Beattie, McInnes, and Fearnley (2004) present a selection of methods for measuring narratives in annual reports, including methods reviewed by Jones and Shoemaker (1994) as well as Healy and Palepu (2001). Beyer, Cohen, Lys, and Walther (2010) expand on this list and include properties of reported earnings. Leuz and Wysocki (2016) enlarge this list and include binary indicators and frequency of disclosure. Table 1 provides an overview of the measures of disclosure identified in these studies; however, our study provides a more comprehensive review and discussion of various methods for measuring disclosure, and further extends the list to include measurements of disclosure through other observable variables such as market-based measures and the voluntary adoption of generally accepted accounting principles (GAAP). It goes further by developing a framework for corporate financial disclosure measurement and discussing some related measurement issues. The purpose of this framework is to provide a consistent approach for systematically collecting, analyzing, and evaluating existent measures of financial disclosure. We hope this will help

³ Healy and Palepu (2001) consider that using these measures of disclosure as independent variables in prior studies are likely to suffer from omitted variable bias.

researchers to make more informed decisions about their choices of measures of financial disclosure or allow them to locate any new measure or method that they develop.

<<Insert Table 1 about here>>

Current gaps in the disclosure literature provide several motivations for our study. Firstly, a framework for disclosure measurement does not currently exist in the literature. Accounting studies do not specifically consider issues involved in measuring disclosure as a latent (unobservable) variable. Secondly, although this literature offers a variety of potential measures for disclosure, to date, there is no comprehensive systematic review that identifies and evaluates existent measures of disclosure. Thirdly, although the assessment of measures of disclosure is discussed to some extent in the extant accounting literature, a comprehensive analysis is lacking. Our study contributes to the literature by filling in these gaps through (i) developing a framework for corporate financial disclosure measurement, (ii) identifying and evaluating common measures of financial disclosure employed in prior empirical studies through a review of the literature from 2005 to 2016, and (iii) providing an in-depth discussion of some related empirical challenges including causal claims, and how the reliability and validity of different measures of disclosure are assessed. The purpose of this review is to help future researchers to identify exemplars and to guide them in the selection or development of their own suitable measures. Additionally, our study highlights some measurement issues related to corporate financial disclosure and provides avenues for future research.

A review of the empirical accounting literature was conducted to identify measures of financial disclosure employed in articles published between 2005 and 2016; articles in accountancy journals that are rated 3* or 4* by the Association of Business Schools were

investigated.⁴ We believe that selecting articles from top rated accounting journals over a 12-year period provides a reasonably up-to-date time frame for this review. Employing a Boolean search for ‘financial reporting’ or ‘financial disclosure’, on the title, abstract and keywords fields of the selected journals over the selected time frame, the results show 2514 articles published between 2005 and 2016. The titles, abstracts and conclusions were then carefully read to identify empirical studies of corporate financial disclosure/reporting in the private sector. We excluded⁵ the following studies: intellectual capital studies, timely disclosure studies, research that empirically examines the economic consequences of individual items of financial disclosure, and image/picture disclosure studies. The application of these research criteria yielded a sample of 280 disclosure studies. Table 2 presents a break-down of these studies by journal and shows that most of them are published in the Accounting Review, Journal of Accounting and Economics, Journal of Accounting Research, and the International Journal of Accounting.

<<Insert Table 2 about here>>

We followed an inductive reasoning approach to develop a framework for disclosure measurement. From specific observations about measurements of disclosure developed in the empirical accounting literature, the analysis moves onto broader generalizations. To inform our analysis, we also consulted the literature on the problem associated with measurement of latent variables (Jarvis, MacKenzie, & Podsakoff, 2003; Goertz, 2008). We

⁴ This choice may seem biased toward US academic journals. The Association of Business Schools rankings are heavily used in the UK during the selection of academic staff and articles to be entered in the periodic Research Excellence Framework exercise by which UK University departments are ranked. US-based, highly quantitative journals are predominant in these rankings. However, in the first version of this paper prior to our systematic review, we did not apply any restrictions to the academic papers covered, and we reached similar conclusions about common financial disclosure measures in the accounting literature.

⁵ We were pragmatically trying to make the review manageable by missing some disclosure areas out.

identified, evaluated and coded the different types of disclosure measures contained within the 280 studies and categorized them into 11 common measures of disclosure. These measures of disclosure are then classified into disclosure-based and non-disclosure-based measures.

The remainder of this paper is organized as follows: in Section 2 we develop a framework for disclosure measurement and identify as well as evaluate different measures of disclosure. In Section 3 we discuss causal claims in prior disclosure studies and explore the extent to which reliability and validity of measures of disclosure are tested within papers identified in the systematic review of the literature. Finally, in section 4 we discuss some measurement issues relating to financial disclosure and highlight areas for future research.

2. A FRAMEWORK FOR DISCLOSURE MEASUREMENT

In this section, we develop a framework to classify various measures of disclosure. To do this, either a deductive or an inductive reasoning approach can be followed.

A deductive reasoning approach works from the more general to the more specific, informally called a “top-down” approach. Applying the deductive approach when constructing or evaluating concepts and quantitative measures, Goertz (2008) suggests, among other things, that the first consideration must be the theory embodied in the concept. Another consideration should be the necessary (minimum) and sufficient (maximum) parts of the concept. However, there is no single theory of disclosure (Verrecchia, 2001), which makes it more complex to develop or evaluate a measure of disclosure. Additionally, empirical studies consider different types of disclosure, for example mandatory and voluntary disclosures. Also, financial disclosure can take different formats such as textual or numerical

disclosure (e.g., Kravet & Muslu, 2013; Nelson & Rupa, 2015). This deductive approach is even more complex when we consider that within a single type of disclosure there are different dimensions that can be captured such as the quality and quantity of information disclosure (e.g., Wynn, 2008; Ernstberger & Grüning, 2013; André, Filip, & Moldovan, 2016). For all these reasons, it is probably impossible to adopt a deductive approach to disclosure measurement.

Alternatively, an inductive reasoning approach can be employed to develop a framework for disclosure measurement. Inductive reasoning is a type of thinking that involves identifying patterns in a data set to reach conclusions and build theories (Hair, Wolfinbarger, Money, & Samouel, 2011, p. 276). It moves from specific observations to broader generalizations and theories, informally called a “bottom-up” approach. Using this approach, we review 280 empirical accounting studies published in top rated accounting journals from 2005 to 2016 and identify⁶ common proxies employed for financial disclosure. Table 3 shows a list of the common measures of disclosure identified in the review of the literature and provides some exemplars for each measure. It shows 11 different measures of financial disclosure with the classification approach being the most popular, while the disclosure survey (analyst ratings) and the voluntary adoption of quality GAAP are the least popular method employed in the recent empirical accounting literature.

⁶ Since human coding is inevitably subjective, to ensure the reliability of our coding, the authors of the papers have agreed on the coding instructions of the different measures of disclosure before the coding took place. When in doubt, the same paper would be coded by both authors and any discrepancies were discussed and resolved. In addition, after the coding was finalized, a random sample of 40 papers has been re-coded (test-retest) by one of the authors. The recoding of measures of corporate financial disclosure was almost identical to the original ones, which indicates the reliability of our coding.

<<Insert Table 3 about here>>

Analyzing these common measures of disclosure, we identify two main measurement methods: a disclosure-based approach and a non-disclosure-based approach. A further classification⁷ relates to whether the non-disclosure-based measure is a formative or reflective variable.

2.1 Disclosure-based approach

This approach investigates actual disclosure and reduces (operationalizes) it to its main dimensions such as quantity, quality, timing, complexity, tone and prominence. It attempts to measure one or more of these dimensions via various means such as textual analysis or the disclosure index approach. Table 4 provides a summary of common disclosure-based measures identified in this review of the literature.

<<Insert Table 4 about here>>

2.1.1 Classification approach

This approach involves sorting observations into mutually exclusive groups according to an aspect of corporate financial disclosure that is being studied. The focus could be broad such as a disclosure policy or a reporting regime, for example whether a firm publicly provide an annual report or files a 10-K report, or narrow such as specific disclosure, for example whether a firm hosts conference calls or provides management forecasts (Leuz & Wysocki,

⁷ We acknowledge that some overlap inevitably exists between the sub-clusters. For example, textual analysis methods can be employed to create textual sentiments, but to recognize that sentiment analysis is not limited to written words only and that it can be employed on quantitative data, we prefer to address it as a separate sub-cluster, even if it has some overlap with textual analysis.

2016). Then, it uses a categorical variable to represent these groups in numerical terms. The resultant measure of corporate financial disclosure could be dichotomous or multicategory. For example, Cannizzaro and Weiner (2015) classify disclosures into minimal, partial, and full disclosure to assess transparency. Marquardt and Wiedman (2007) measure the quality of disclosure by classifying information on contingently convertible securities to “high-quality” if the number of shares related to the convertible securities is disclosed; “medium-quality” if enough information is provided for investors to calculate the dilutive impact; and “low-quality” if insufficient information is provided. Gillan and Panasian (2014) sort firms into cross-listed (foreign) firms filing a 40-F, 20-F, 10-K form, or their US-matched domestic counterparts to capture the differential disclosure complexity in these filings. Hollander et al. (2010) assess incomplete disclosure by determining whether requests for information made during conference calls are granted. If at least one request is not granted, they mark this call as containing incomplete disclosure. Bowen et al. (2005), Files, Swanson, and Tse (2009), and Marques (2010) assess the prominence of disclosure using a classification approach based on the position of information in the disclosure vehicle.

A classification approach is commonly applied to specific disclosures such as conference calls, segment information, management forecasts, disclosure of non-GAAP numbers, material restatement and material weakness disclosures, and financial statement disclosure (e.g., Kimbrough, 2005; Botosan & Stanford, 2005; Marques, 2006; Nagy, 2010; Weiss, 2014; Bernard, 2016). However, given the simplicity of this approach, it can be applied to any type of disclosure.

The data have the advantages of being relatively time-efficient to collect and code and can be used for large-scale samples. This might explain the popularity of this method among

prior studies with 112 cases identified in the current systematic review of the literature. This approach is able to capture one type of disclosure at a time (e.g., voluntary, or mandatory) in contrast to other methods which fail to separate between these two types of disclosure such as disclosure survey and market-based measures. In addition, Leuz and Wysocki (2016) argue that this approach focuses on the existence of certain disclosures and hence disclosure can be precisely measured. Perhaps this is true when the focus of the measure is narrow, but still other disclosure activities might act as a substitute or a complement which need to be controlled for in the research design. When the focus of the measure is broad, however, at best they only partition companies into mutually exclusive groups (with some sort of order emerging if ordinal variables are employed), without any attempt to capture differences in the dimension of disclosure among companies that belong to the same group. In addition, coding could be subjective, in particular when weights are assigned, and hence results could be difficult to replicate, compare and generalize.

2.1.2 Disclosure index

A disclosure index⁸ is a research instrument used to assess the extent of information reported in a disclosure vehicle(s) by a specific entity according to a list of selected items of information. The items of information could be quantitative or qualitative or both. It can be applied to different types of disclosures: mandatory or voluntary; or even to a specific type of

⁸ Both the disclosure index method and textual analysis could be generally viewed as sub-types of content analysis because we are trying to draw valuable information from the data to the context of their use (Krippendorff, 1980). However, these two methods differ from each other in several aspects. For example, the unit of analysis under the disclosure index method could be figures or texts or both, while the unit of analysis under textual analysis is texts only. Using a disclosure index method, the researcher assesses whether disclosures have been made about some selected items of information, in contrast to the commonly used bag-of-words methods in textual analysis, for example, where the focus is on word count or word frequency, and where word sequence is ignored. Furthermore, while only human coding is used to develop disclosure scores using a disclosure index method, textual analysis can be conducted either manually or electronically. Therefore, we prefer to address these two methods separately.

disclosure such as management forecasts and segmental data. It does not count all items of information disclosed, but rather assesses whether disclosures have been made about the selected items of information through a close reading of the disclosure vehicle. Thus, the selection of items to include in the disclosure index is a key issue with this approach (Marston & Shrives, 1991). It can also be extended to assess the usefulness of information provided by awarding scores on an ordinal scale (e.g., 0/1/2/3) for disclosures of each item in a list (e.g., disclosures that contain quantitative data or report more information would receive a higher score than a minimal level of disclosure). However, the assignment of weights is itself subject to conceptual and procedural problems (e.g., Dhaliwal, 1980; Cooke & Wallace, 1989; Hodgdon et al., 2009; Cheung, Jiang, & Tan, 2010). The first use of such an index was by Cerf in 1961, and the method has been widely employed ever since (Marston & Shrives, 1991).

A disclosure index can be developed by the researcher (self-constructed disclosure indices) or developed externally by an academic or professional body (existing disclosure indices) such as Standard and Poor's transparency and disclosure scores, US Securities and Exchange Commission (SEC) ratings of the management discussion and analysis disclosure, the Center for International Financial Analysis and Research (CIFAR) disclosure scores, and the Joint Society of Management Accountants of Canada/University of Quebec and Montreal disclosure scores. Our review finds that the disclosure index approach is one of the most popular measures of disclosure; it is used in a variety of contexts indicating how flexible the method is. From our review of the literature, 50 cases were identified, including self-constructed disclosure indices as well as existing disclosure indices. A more detailed analysis reveals that most studies use self-constructed disclosure indices with data extracted from company reports and websites (e.g., Webb, Cahan, & Sun, 2008; Hodgdon et al., 2009; Melis

et al., 2015; Mangena et al., 2016; Bazrafshan, Kandelousi, & Hooy, 2016), but some use the CIFAR index (e.g., Guedhami & Pittman, 2006; Han et al., 2012) or Standard and Poor's transparency and disclosure scores (e.g., Dargenidou et al., 2006; Ali, Chen, & Radhakrishnan, 2007).

Self-constructed disclosure indices have the advantage that they can be designed to fit the project (e.g., country, voluntary and/or mandatory disclosure, disclosure topic). However, the use of existing disclosure indices saves time, and results can be compared with the findings from other studies. Self-constructed disclosure index studies generally employ small samples owing to the labor-intensive data collection process, and results obtained are often difficult to replicate, compare and generalize (Hassan, Romilly, Giorgioni, & Power, 2009; Beyer et al., 2010). In addition, the construction of a disclosure index in prior studies often fails to explicitly account for the incremental information content of each new data item added to the index. Future research may develop an approach that can better capture the incremental information content of additional items of information disclosed by means of data reduction techniques such as factor analysis and principal component analysis. Furthermore, the appropriate method of aggregation is also of relevance here. For example, two companies may have disclosed completely different sets of information within the disclosure index and receive the same disclosure score.

2.1.3 Disclosure count

This approach counts the number of distinctive disclosures usually, but not necessarily, without evaluating their content or context. For example, the number of press releases (Francis, Nanda, & Olsson, 2008), the frequency of disclosure of non- GAAP earnings measures over a period of time (Marques, 2010), the number of online announcements

(Debreceeny & Rahman, 2005), the number of segments reported by a firm (Kou & Hussain, 2007), and the number of internal control weaknesses reported by a firm in its Management Discussion & Analysis (Lu et al., 2011). This approach usually relates to particular types of disclosure such as conference calls, management forecasts, disclosure of non-GAAP numbers, information about material restatements and weakness, and segmental data (e.g., Rogers & Van Buskirk, 2009; Bergman & Roychowdhury, 2008; Marques, 2006; Lu et al., 2011; Kou & Hussain, 2007). It is frequently used in conjunction with a classification approach (e.g., Ge & McVay, 2005; Wasley & Wu, 2006; Francis et al., 2008; Levine & Smith, 2011).

Our systematic review shows that disclosure count is one of the most popular measures of disclosure with 36 cases identified from the articles analyzed. It is commonly used to measure the quantity of disclosure (Francis et al., 2008; Fu et al., 2012; Baginski, Clinton, & McGuire, 2014), but it has also been used to assess other dimensions of disclosure such as quality (Sengupta & Zhang, 2015), the quantity and quality of disclosure (Wynn, 2008; Cuny, 2016) as well as the complexity (Kou & Hussain, 2007; Brochet et al., 2016), and credibility (Lu et al., 2011) of disclosures.

The data have the advantage of being relatively time-efficient to collect and code and the data can be used to study large scale samples. Disclosure count can provide new valuable information to the capital market, for example the management might hold frequent conference calls to update outside providers of funds on relevant up-to-date information about the business. However, it could also be induced by other managerial incentives such as management reputation.

2.1.4 Properties of reported earnings

This approach uses properties of reported earnings to measure financial reporting quality (e.g., Wang, 2006; Altamuro & Beatty, 2010; Chen et al., 2011; Kim & Venkatachalam, 2011; Koh et al., 2013; Filip et al., 2015). For example, while Krishnan, Wen, and Zhao (2011) use accruals quality and discretionary accruals to measure financial reporting quality, Altamuro and Beatty (2010) use various characteristics of reported earnings such as changes in loan-loss provision, earnings persistence, earnings predictability, benchmark beating behavior, and accounting conservatism. Lang, Lins, and Maffett (2012) measure firm transparency by less evidence of earnings management using properties of reported earnings, among other measures such as better accounting standards, higher quality auditors, more analyst following, and more accurate analyst forecasts.

Coding of these variables could be relatively easy and time-efficient and can be used for large-scale samples because these variables are constructed by means of economic modelling of available accounting figures rather than coding texts. Furthermore, both continuous and discrete proxies can be constructed. Dechow, Ge, and Schrand (2010) review different measures of earnings quality such as the magnitude of accruals, residuals from accrual models and earnings persistence among others, and reach no single conclusion on what earnings quality is, because “quality” is dependent on the decision context. Thus, different properties of reported earnings may capture different dimensions of quality and may be valid in different contexts (Berger, 2011). Dechow et al. (2010) also suggest that properties of reported earnings capture underlying earnings process with errors that are related to fundamental firms’ characteristics, real economic performance and the measurement of performance, a problem that is common for almost all measures of

disclosure (Leuz & Wysocki, 2016). Dechow et al. (2010) further suggest that different proxies based on reported earnings are not equally affected by these factors which emphasizes that these measures are not measuring the same underlying construct. In addition, corporate financial disclosure is not limited to the accounting figures disclosed in the financial statements. It also includes qualitative information in the form of text (e.g., Core, 2001; Easley & O'Hara, 2004; Beyer et al., 2010). Thus, using accounting quality to proxy for the overall quality of corporate financial disclosure would be limited. Leuz and Wysocki (2016) consider attributes of reported earnings as narrow measures of corporate disclosure and reporting which have the advantages of being able to facilitate consistent measurement across firms, but these measures raise concerns about other disclosure activities that could serve as a substitute or a complement, which need to be controlled for in the research design. For example, firms can compensate poor earnings quality with enhanced voluntary disclosure. Even though, whether earnings quality could serve as a substitute or a complement of disclosure quality is still an empirical issue since some scholars suggest that they are substitutes (Mouselli, Jaafar, & Hussainey, 2012), while others suggest that they are complements (Francis et al., 2008).

2.1.5 Sentiment analysis

Scholars have used both quantitative and qualitative financial information to generate sentiments from corporate financial disclosure such as good/bad news disclosure and favorable/unfavorable disclosure. Some of the pioneer studies in this area include Clarkson, Kao, and Richardson (1994) and Skinner (1994). For example, Clarkson et al. (1994) measure voluntary disclosure of good (bad) news by positive (negative) changes in earnings in the current year compared to those of the previous year (or analysts' forecasts of earnings).

Alternatively, a firm is classified as good news if the cumulative residuals from the market model for the firm over the eight-month period after the annual report date are larger than zero. Ali et al. (2007) use the change in earnings per share from that of the same quarter in the previous fiscal year, deflated by stock price at the beginning of the quarter as a measure for voluntary disclosure of bad news (negative changes) and vice versa. Bamber et al. (2010) measure good/bad news disclosure by the difference between the management forecast and the most recent I/B/E/S consensus analyst forecast, deflated by the closing price one day prior to the management forecast date. If the difference is non-negative (negative), this is coded as good (bad) news, and 0 otherwise. Desir (2012) measures good/bad news disclosure based on changes in dividends, where an increase in dividends is considered good news, while a decrease is considered bad news.

In addition, both manual and automated textual analysis methods are used to measure the tone of a financial document (e.g. Skinner, 1994; Kothari et al., 2009; Li, 2010b; Rogers et al., 2011; Yekini et al., 2016). For example, Skinner (1994) constructs a measure of disclosure where disclosures are subjectively classified as good/bad/no news via manual textual analysis if the particular disclosure documents indicate that earnings will be better/worse/same compared to investor expectations. Rogers et al. (2011) use a dictionary-based text analysis program to quantify optimistic tone on a continuous scale. Kravet and Muslu (2013) measure the negative tone in risk disclosures by changes in companies' textual risk disclosures in the 10-K filings and provide evidence that textual risk disclosures reveal new information about corporate risks and uncertainties. Kearney and Liu (2014) survey different textual analysis methods applied on textual sentiment in the finance literature such as word lists, dictionary-based approach, and supervised machine learning. They suggest that

corporate disclosure literature often use the term 'tone' to refer to textual sentiment, but sentiment in a broader term is not limited to positivity–negativity, but also include other affects such as strong–weak, and active–passive. Loughran and McDonald (2016) find that much of the literature uses a bag-of-words approach, where the word sequence is ignored, and the characters of a document is parsed into chunks of words, to measure document sentiment.

Sentiment analysis can be applied to both quantitative and qualitative financial information which indicates the flexibility of the method. Sentiments created from quantitative data, and textual sentiments developed using automated textual analysis are economical in terms of money, time and effort needed to implement the analysis, and can be applied to large samples. Both continuous and discrete proxies for disclosure can be constructed. However, the approach is inevitably subjective, hence the results could be hard to replicate and generalize, in particular with textual sentiments. In addition, while quantitative data can be distorted for several reasons such as earnings management, textual sentiments can be driven by different managerial incentives such as management reputation and impression management. In addition, textual sentiment analysis could be biased because of a managerial tendency to use positive words to frame negative statements (Loughran & McDonald, 2016). Perhaps future research should consider both quantitative and qualitative sentiments to control for this potential bias. Future research might also investigate how sentiments created using quantitative data compare with textual sentiments.

2.1.6 Textual analysis

Textual analysis is a research method to draw inferences from texts to the context of their use. Loughran and McDonald (2016) suggest the following hierarchy⁹ of textual analysis: lexical, collocation, syntactic, semantic, pragmatic, and discourse. They claim that, to date, applications in accounting and finance are predominately in the initial phase of this interpretive sequence of lexical to discourse analysis.

We discuss textual analysis to the extent relevant to the current study and refer the reader to several excellent review studies on the subject (e.g., Jones & Shoemaker, 1994; Li, 2010a; Guo, Shi, & Tu, 2016; Loughran & McDonald, 2016; Grimmer & Stewart, 2013) for more in-depth discussion of the different methods employed under this approach. For example, Li (2010a) surveys recent empirical large-scale textual analysis studies by topical area (e.g., information content, earnings quality, market efficiency), and provides details on earlier manual-based textual analysis studies. Loughran and McDonald (2016) survey readability methods which attempts to measure the ability of the reader to decipher the intended message, and methods which typically focus on computationally extracting meaning from a collection of text such as bag-of-words methods and measuring document similarity. They address various methodological tripwires involved in these methods, highlight the challenges of separating out the concepts of business complexity and readability, and

⁹ Loughran and McDonald (2016, pp.26-28) explain this hierarchy as following: the first step in analyzing text is *lexical* (bag-of-words) where the word sequence is ignored, and the characters of a document is parsed into chunks of words. Research interests at this stage are focused on some linguistic features such as word count, word difficulty and word frequency (Beattie, 2014). The second step, *collection*, is where meaning is derived from a collocation of words (or grams). For instance, the bigram of “going” and “concern” is an example where collocation is important, and if we extend this to *n*-grams, we can identify a collection of words as a sentence. Then using *syntactic* analysis, we can derive additional information by examining the grammatical structure of the sentence. Beyond syntax, *semantics* attempts to infer meaning within the context of the sentence. *Pragmatics* infers meaning from information immediately preceding and following the sentence, in addition to context provided by external knowledge. Finally, *discourse* is the attempt to derive meaning from the collective document.

emphasize the importance of replicability in the less-structured methods used in textual analysis. While, Guo et al. (2016) classify textual analysis methods into lexicon-based approach and machine learning approach, where the former includes readability measures and dictionary-based approach, and the later includes Naïve Bayes, Support Vector Machines, Semantic Analysis and Neural Network.

Textual analysis is commonly used to measure the quantity of disclosure (e.g., Chen, Cheng, Gong, & Tan, 2017a). However, the method is also used to assess other dimensions of disclosure such as quality (e.g., Chen, Miao, & Shevlin, 2015), complexity (e.g., You & Zhang, 2009; Filzen & Peterson, 2015) and horizon (Brochet, Loumiotis, & Serafeim, 2015). The disclosure being studied can be mandatory, voluntary, or both, which highlights the flexibility of the method. Textual analysis can be partial or comprehensive. Partial textual analysis covers part of a document or selected items of information or key words. Comprehensive textual analysis covers a whole document.

Textual analysis can be conducted manually or automatically. One of the major limitations of manual textual analysis is that it is a labor-intensive data collection process, which inevitably tends to restrict the sample size employed (Beattie & Thomson, 2007). Therefore, in the 1980s, automated textual analysis emerged and has been commonly employed ever since (e.g., Frazier, Ingram, & Tennyson, 1984; Abrahamson & Amir, 1996; Smith & Taffler, 2000; Breton & Taffler, 2001; Schleicher, Hussainey, & Walker, 2007; You & Zhang, 2009; Brown & Tucker, 2011). Automated textual analysis is often accompanied by some element of manual textual analysis depending on the research method. Examples of studies that use automated textual analysis are Schleicher et al. (2007), You and Zhang (2009)

and Elshandidy, Fraser, and Hussainey (2015), and examples of manual textual analysis studies are Linsley and Shrives (2006), Boesso and Kumar (2007), and Chen et al. (2017a).

Automated textual analysis is easy to use and economic in terms of the time, effort and financial resources needed to implement the method. It can be easily used to conduct a comprehensive textual analysis and to cover sizable samples. However, textual analysis is not problem-free. When implementing this approach either manually or automatically using the frequency of words or key words, all possible synonyms and words with multiple meanings should be included (Weber, 1990). Using inappropriate or insufficient key words could lead to over- or underestimation of a disclosure level. Additionally, using words or key words isolated from their context in the whole sentence does not provide a sound unit of analysis and may yield misleading results (Milne & Adler, 1999; Beattie & Thomson, 2007). Furthermore, coding (either manually or electronically) that is entirely based on a pre-defined word list without recourse to actual disclosure content may not be able to fully capture the construct under investigation, which limits the validity of the constructed measure of disclosure (Beattie & Thomson, 2007; Grüning, 2011; Loughran & McDonald, 2016). Moreover, the focus of this method is on reported qualitative information, which means that quantitative information will be ignored under this approach.

Attempts to extend this approach beyond lexical analysis include, but are not limited to, the analysis of phrases rather than words and semantic analysis. For example, Grüning (2011) uses an information-retrieval vector space model (VSM), a supervised machine learning tool, to automatically analyze phrases (n-grams) rather than words; he argues that this provides better unit of analysis and eliminates human involvement in the process. Using VSM, Grüning (2011) undertakes the coding of corporate disclosure in two phases: training

and application. In the training phase, Grüning manually develops a comprehensive coding scheme based on a sample of representative annual reports, attempting to classify and quantify the diversity of corporate financial and non-financial disclosures. In the application phase, the coding scheme is automatically applied to a larger number of annual reports without human involvement to develop a disclosure score. Brown and Tucker (2011) provide another example of advancement in this area where they use VSM to measure changes in disclosure documents based on identifying semantic similarity. Changes in disclosure rather than disclosure levels could give us more meaningful insights about disclosure practice by removing boiler-plate disclosure for instance. However, the measure obtained is a summary of changes in a document and does not specify the nature of any changes in disclosure which have taken place (Berger, 2011).

2.1.7 Attributes of management forecasts

A management forecast is an item of forward-looking information, which management may provide in annual reports, interim reports, or elsewhere. This information may be quantitative (where a specific figure or range of figures is supplied) or qualitative (where a general direction or trend in company performance might be given). For example, management earnings forecasts available in the First Call database can take the following forms: point, range, one-sided directional, or confirming statements. They can be verified through actual earnings realizations, and hence they enable researchers to construct variables such as management forecast accuracy, error and bias. Recent studies also use management forecasts of cash flows, capital expenditures and store openings (e.g., Adhikari & Duru, 2006; Wasley & Wu, 2006; Cole & Jones, 2015) to construct their measure of disclosures.

Management forecasts have been used widely in the accounting literature to assess voluntary disclosure quantity and quality, especially studies from the US¹⁰. This may be because of the availability of these data in different databases such as that provided by First Call and the Dow Jones News Retrieval Service. Some studies only use attributes of management forecasts to assess the quality of voluntary disclosure (e.g., Yang, 2012; Bonsall et al., 2013; Cole & Jones, 2015; Kitagawa & Okuda, 2016; Zuo, 2016). While management earnings forecasts have the advantages of being concrete disclosure events, they are considered less comprehensive than other measures of disclosure such as AIMAR disclosure scores (Lang & Lundholm, 1996). In addition, management forecasts could be driven by different managerial incentives other than facilitating communication with external providers of funds such as management reputation and earnings management, which would affect the credibility of measures of disclosure developed from management forecasts (Kim & Park, 2012; Beyer & Dye, 2012; Cheng, Luo, & Yue, 2013). However, attributes of management forecasts are relatively easy and time-efficient to construct and can be used for large-scale samples. Also, both continuous and discrete proxies for disclosure can be constructed using attributes of management forecasts (e.g., Baginski & Rakow, 2012; Bonsall et al., 2013).

2.2 Non-disclosure-based approach

The second measurement approach views disclosure as a latent (unobservable) variable, and thus measures it through some other (non-disclosure-based) observable variables such as market-based data and the adoption of high-quality accounting standards.

¹⁰ While management earnings forecast disclosure is voluntary in the US market, it is mandatory for Japanese companies listed on a stock exchange (Suto & Takehara, 2018).

These observable variables are assumed to relate to the underlying concept (disclosure) that needs to be measured.

Non-disclosure-based observable variables can be further classified into formative and reflective variables. The difference between formative and reflective variables is in the theorized direction of causality between the latent variable and the observable variables (e.g., Fayers & Hand, 2002; Jarvis et al., 2003). If the direction of causality is from the latent variable to the observable variables, and if changes in the latent variable are hypothesized to cause changes in the observable variables, then these measures are referred to as reflective variables. If the observable variables are hypothesized to cause changes in the latent variable, then they are referred to as formative variables. In the context of financial disclosure, possible examples of reflective variables are disclosure surveys and market-based measures of disclosure. This is because the direction of causality is hypothesized to be from corporate financial disclosure to these observable variables. Possible examples of formative variables are regulatory change, the adoption of high-quality accounting standards, and the use of American depositary receipts. This is because these observable variables are hypothesized to cause changes in corporate financial disclosure. Jarvis et al. (2003) provide decision rules for determining whether a measure is formative or reflective, although they note that answering the questions associated with these rules may be difficult and the answers may be contradictory. Although non-disclosure-based measures are less labor-intensive for researchers to develop because they do not require detailed analysis and coding of disclosure instruments and can be used for large-scale samples, their relationship with disclosure may be weak or bidirectional. In addition, using a reduced-form research design, that is not following the entire causal path between corporate disclosure and the variables of interest,

makes the analysis susceptible to omitted variable bias, e.g. the change in the variable of interest could be triggered by other omitted confounding variables such as institutional changes and economic shocks (Leuz & Wysocki, 2016). Table 5 provides a summary of common non-disclosure-based measures identified in the current review of the literature.

<<Insert Table 5 about here>>

2.2.1 Formative measures

(i) Regulatory change that affects disclosure

Many prior studies use a regulatory change event to proxy for a change in disclosure quantity or quality or both. For example, Zhou (2007) investigates the link between information asymmetry and increased accounting disclosures following the adoption of new auditing standards using a dummy variable that takes the value of one if the observation is from the post-adoption period, and zero otherwise. Wang (2010) uses a dummy variable equal to zero for the years 1998 through 2001 and one for the years 2002 through 2005 to proxy for increased internal control disclosures mandated by the Sarbanes-Oxley Act (SOX). Leuz et al. (2008) analyze the effects of SOX on SEC deregistration and examine the causes and consequences of a significant and voluntary decrease in a firm's commitment to disclosure which they attribute largely to SOX. Bonaimé (2015) uses a categorical variable to proxy for increased transparency around the 2003 modification to SEC Rule 10b-18, which mandates enhanced disclosure of repurchase transactions. Other studies (e.g., Herrmann, Hope, & Thomas, 2008; Canace, Caylor, Johnson, & Lopez, 2010; Chen, Dhaliwal, & Xie, 2010) examine the consequences of Regulation Fair Disclosure, which prohibits the disclosure of material non-public information to selected groups or individuals such as financial analysts or

institutional investors. These studies use a dummy variable to proxy for the quantity and quality of disclosure.

The method is easy to use and economical in terms of the time, effort and money consumed in constructing a proxy for a change in disclosure. Data to construct these variables either come from the event date or filings or databases containing information related to the event. However, the variables merely indicate that a change in disclosure either has/has not taken place, with no attempt to measure the size of this change. In addition, there is no attempt to assess the actual level of compliance with the regulatory change, which could be problematic; particularly in the absence of strong enforcement policies. Leuz and Wysocki (2016) suggest that the observed outcomes around a regulatory change are joint effects of that change and institutional complementarities such as the auditing supervisory agencies, and legal remedies. The impact of the institutional settings will also limit the ability to generalize the outcomes to other environments even if the causal relationship between a regulatory change and the variables of interest is correctly observed.

(ii) Voluntary use of GAAP (e.g., US GAAP or IFRS) to indicate higher disclosure (GAAP)

Several prior studies construct dummy variables about the voluntary adoption of GAAP which are used to proxy for higher disclosure (e.g., US GAAP or International Financial Reporting Standards [IFRS]) versus lower disclosure (local GAAP). For example, Van Tendeloo and Vanstraelen (2005) examine whether the adoption of IFRS is associated with lower levels of earnings management using a dummy variable that takes the value of one if the firm voluntarily adopts IFRS and zero otherwise; this dummy variable is used to proxy for enhanced financial reporting quality. Another example is Frino et al. (2013) who use the early adoption

of IFRS in Italy to proxy for increased disclosure and examine its effect on stock liquidity. A further example is Wan–Hussin (2009) who use the early adoption of an accounting standard associated with greater disclosure, namely the disaggregation of accounting information by business segments to proxy for corporate transparency.

Data to construct the variable can be retrieved from databases, or researchers may need to inspect companies' annual reports. These data have the advantage of being relatively time-efficient to collect and code and can be used for large-scale samples. However, the use of a dummy variable only splits companies into two mutually exclusive groups where actual disclosure can still differ among the members of the same group.

2.2.2 Reflective measures

(i) Market-based measures

Market-based measures¹¹ have been used to proxy for disclosure quantity or quality in prior studies (e.g., Ascioğlu et al., 2005; Rogers, 2008; Rogers & Van Buskirk, 2009; Reeb & Zhao, 2013). For example, Rogers (2008) uses changes in market liquidity to proxy for disclosure quality based on the argument that high-quality disclosure improves market liquidity. However, Berger (2011) notes that changes in market liquidity may arise for reasons other than changes in disclosure quality, that is the omitted variable problem. This problem can be eliminated by using control variables and validation tests, but the number of control variables needed might be sizeable. According to Berger (2011), Rogers' (2008) attempt to include controls provides some validation for his measure of disclosure.

¹¹ We only provide some examples of market-based disclosure measures; thus, this should not be interpreted as a complete list of these measures.

Market-based measures of disclosure have the advantage of being easily obtainable from databases and can be estimated for large samples. Also, they can be constructed using both discrete and continuous variables. However, these measures usually suffer from a lack of theoretical casual path linking them with disclosure. In addition, failure to integrate market efficiency into the discussion could be a fatal oversight (Verrecchia, 2001). Moreover, the availability of these measures will be limited to listed companies only which indicates potential selection bias. Furthermore, market-based measures are noisy measures of corporate financial disclosure because they are likely to capture both public and private information, financial and non-financial information, and information provided by the company and by a third party such as financial analysts and the media. They are also likely to capture not only a firm's disclosure practice but also its fundamental characteristics and performance.

(ii) Disclosure survey

A disclosure survey is an investigation of the perceptions of financial analysts, investors, or other user groups about firms' disclosure practices through questionnaires or interviews (e.g., Nikolaev & Van Lent, 2005; Daske & Gebhardt, 2006; Brown & Hillegeist, 2007; Glaum et al., 2013).

Perhaps the most common example of a disclosure survey in the empirical accounting literature is that conducted by the Financial Analysts Federation and the Association for Investment Management and Research (AIMR), where results of these surveys have been used as proxies for disclosure quantity and quality in many prior US studies (e.g., Dhaliwal, Khurana, & Pereira, 2011; Huang & Zhang, 2012; Ali, Klasa, & Yeung, 2014). Original scores about the importance of different disclosures can be also converted into a dummy variable

(e.g., Brown & Hillegeist, 2007). However, these scores are now out of date, given that they were discontinued in 1997 after the fiscal year 1995 (Core, 2001). Since then, several regulatory changes have taken place in the US that may have an impact on firms' disclosure practices (Ertimur, 2007); the earlier survey evidence may therefore be redundant.

Other examples of studies using disclosure survey results in a European context are those of Daske and Gebhardt (2006) and Glaum et al. (2013). Both studies use quality scores extracted from competitions for the best annual reports run by business journals to proxy for disclosure quality.

Disclosure scores constructed by third-party organizations from surveys that they have conducted are not labor-intensive for a researcher because they are already completed. If the survey is applicable to a wide range of organisations, they can be employed for a sizable sample of firms compared to other research methods, such as the self-constructed disclosure index. Additionally, the scores obtained are usually constructed by using inputs from professional analysts familiar with the firms' disclosures, and thus claimed to enable direct measurement of disclosure quality (Glaum et al., 2013). The scores are also claimed to capture both the quantity and quality of disclosure since they provide useful information to expert users of this information (Leuz & Wysocki, 2016). However, this approach is based on analysts' (or other user groups') perceptions about firms' disclosure rather than actual disclosure (Lang & Lundholm, 1993; Beattie et al., 2004). Moreover, the ratings are potentially biased towards large firms which tend to feature prominently in the surveys. Additionally, the objectivity of the views of the investigated user group may be doubted, given that no one will know the user group's incentives to supply their ratings and the types of biases that may be present (Lang, 1999).

3. SOME EMIRICAL CHANLLENGES

In this section we discuss some measurement issues related to the development of a measure of disclosure. These are causal claims and reliability and validity assessment.

3.1 Causal claims

A major empirical issue that most prior empirical studies on corporate financial disclosure face is the causal claim, whether implicit or explicit, made between corporate financial disclosure and other observable variables. Such a claim must first be grounded in theory, that is the causal link between corporate financial disclosure and the observable variables is established in theory, and properly examined using suitable econometric methods. Scholars often borrow theories from economics, finance and psychology to establish a theoretical causal link between corporate financial disclosure and other observable variables (e.g., Healy & Palepu, 2001; Knooe, Seybert, & Smith, 2011). Gow, Larcker and Reiss (2016) view that accounting research needs a clear discussion of the theoretical causal mechanism that is being assumed for the research question and suggest researchers to use causal diagrams to be very transparent about such claims. However, a lack of a relevant theory that links corporate financial disclosure with other observable variables could be an issue. For example, Core (2001, p.449) suggests that tests of a link between disclosure quality and the cost of capital are joint tests of a theory linking disclosure quality to information asymmetry and a theory linking information asymmetry to a cost of capital. Even when a strong theoretical link between corporate financial disclosure and other observable variables can be established, a causal claim may still not be attainable if the variables are endogenous. Endogeneity occurs when the explanatory variable correlates with the error term of the estimation model. This will result in inconsistent and biased estimation

of the coefficient of the explanatory variable, that is it does not converge to its true population value no matter how large the sample size is. This, in turn, means that the effect of the independent variable on the dependent variable cannot be interpreted. Some scholars shy away from inferring a causal link between disclosure and other observable variables, claiming that they are testing for association rather than causation. However, if endogeneity exists, even a simple correlation between the dependent variable and independent variable cannot be inferred because the magnitude of the effect can be wrong as well as its sign (Antonakis, Bendahan, Jacquart, & Lalive, 2010). Endogeneity occurs for a variety of reasons such as omitting important control variables from the estimation model, omitting fixed effects, omitting confounding variables, reverse causality, measurement errors in the independent variables, and model misspecification, among others (Ibid). For example, most disclosure studies either examine the determinants or consequences of disclosure but not both, which might fail to account for the full causal chain between disclosure and the variables of interest. This is called a reduced-form research design, which makes the analysis susceptible to endogeneity bias.

Examples¹² of prior studies which explicitly control for endogeneity bias in corporate financial disclosure literature are Nikolaev and Van Lent (2005), Lapointe–Antunes et al. (2006), Altamuro and Beatty (2010), Lim, Matolcsy, and Chow (2007), and Hope and Thomas (2008). For example, Nikolaev and Van Lent (2005) investigate two sources of endogeneity bias that affect the estimation of the relation between cost-of-debt capital and disclosure, namely: unobservable firm heterogeneity and observable omitted variables. They attempt to

¹² We were not specifically looking for discussions of endogeneity issue in prior studies when we did our survey, so this is not to be interpreted as a comprehensive list of studies that dealt with this issue in this review.

mitigate this endogeneity bias by relying on theory to identify additional variables correlated with both disclosure and cost-of-debt capital and by applying fixed effects estimation. Another source of endogeneity bias is reverse causality, which means that the relationship between corporate financial disclosure and other observable variables could be bi-directional. For example, Brown and Hillegeist (2007) control for the endogeneity bias caused by a reverse causality between disclosure quality and information asymmetry by employing a simultaneous equations approach.

Antonakis et al. (2010) provide an excellent review of the different sources of endogeneity bias and present methods that allow social scientists to test causal claims in non-experimental settings where randomization is not possible, such as simultaneous-equation models, Heckman selection models, regression discontinuity and difference-in-difference models, among others. Attempts to discuss sources of endogeneity bias in the accounting literature include Larcker and Rusticus (2010), Tucker (2010), Peel (2014; 2016), Gow et al. (2016), and Leuz and Wysocki (2016). For example, Larcker and Rusticus (2010) provide some insights into the use of instrumental variables and simultaneous equations by accounting researchers to mitigate the biases caused by endogeneity of the predictor variables. Table 1 in their study shows that disclosure research makes use of instrumental variables and identifies other accounting research areas such as auditing and earnings management. Gow et al. (2016) evaluate the different approaches accounting researchers adopt to draw causal inferences from observational data based on a review of all papers published in three leading accounting journals in 2014. They find that about 90% of these papers seek to draw causal inferences and that the most common estimation methods used in these studies include ordinary least-squares regression, difference-in-differences estimates, and propensity-score

matching. However, they claim that the assumptions required for these methods to deliver credible estimates of causal effects are unlikely to be met in many applications that rely on observational data. They suggest that accounting research would benefit from more in-depth descriptive research, including a greater focus on the study of causal mechanisms and increased emphasis on the structural modeling of the phenomena of interest. Leuz and Wysocki (2016) discuss how all measures of corporate disclosure and reporting share a fundamental problem which is the need to separate a firm's reporting from its underlying economic characteristics and performance. However, corporate economic characteristics, disclosure policy and performance are co-determined by management strategy, that is management strategy identifies what a firm does and how it performs, and that the omission of this variable from the study methodologies causes an endogeneity problem. Leuz and Wysocki (2016) suggest structural equations modelling, among others, to address this problem. Tucker (2010) and Peel (2014; 2016) discuss selection bias in accounting research that is due to both observable and unobservable differences between the selected control firms and the sample firms in evaluating treatment effects and suggest methods to control both types of bias.

3.2 Reliability and validity assessment

In our search for measures of corporate financial disclosure, we observe that most studies tend to use a single measure of disclosure. Some studies use more than one measure for disclosure to examine different aspects of corporate disclosure or to check the robustness of their results. For example, Francis et al. (2008) use a disclosure index, as well as four categories of disclosure within the index, and finally, three alternative measures of voluntary

disclosure: management forecast behaviour, number of firm-initiated press releases, and conference call activity.

However, whether a study uses one or more measures for corporate disclosure, and whatever the approach or scale used to develop it, it is constructed to approximate a theoretical concept that is difficult to measure directly. Hence, it is necessary to assess whether the measure of disclosure employed is a reliable and valid one. If the measure is not reliable and invalid, the resultant statistical inferences will not be meaningful. Although assessment of measures of disclosure is discussed to some extent in the accounting literature, a comprehensive analysis is lacking. Therefore, this section discusses the extent to which testing for reliability and validity is carried out within papers identified in our systematic literature review. Table 6 shows a list of the papers that have conducted some sorts of reliability and validity testing.

<<Insert Table 6 about here>>

3.2.1 Reliability Assessment

Reliability concerns the ability of a measurement instrument (e.g., a disclosure index) to produce consistent results in repeated trials. It also concerns the internal consistency of a measurement instrument, that is, the extent to which all parts of a measurement instrument are measuring the same thing (Carmines & Zeller, 1991). Reliability has three common forms: test-retest, inter-coder reliability, and internal consistency.

The test-retest measures the stability of the results obtained from a measurement instrument over time. In terms of textual analysis, for example, stability can be determined when the same text is coded more than once by the same coder (Weber, 1990, p. 17). Al-Akra

and Ali's (2012) study is one example of how the test-retest approach can be used in manual coding for a self-constructed disclosure index. They rely on one coder in the coding process, and to reduce coding error, the annual reports were screened twice with the voluntary disclosure checklists.

Reproducibility or inter-coder reliability refers to the extent to which content classification produces the same results when the same text is coded by more than one coder (Weber, 1990, p. 17). Inter-coder reliability can be measured by the coefficient of agreement (e.g., Al-Shammari et al., 2008), which is the ratio of the number of pairwise inter-judge agreements to the total number of pairwise judgements (Beattie et al., 2004, p. 214). The higher the coefficient obtained, the higher the reliability of the measurement instrument. Because this measure does not consider the likelihood of random agreement between the coders, it is not perceived as an adequate measure of inter-rater reliability unless discrepancies between the coders are scarce or the discrepancies have been analyzed and any differences have been resolved (e.g., Rogers & Grant, 1997; Milne & Adler, 1999). To overcome the problem of random agreement between the coders, other measures including Scott's pi (e.g., Linsley & Shrives, 2006; Abraham & Cox, 2007), Krippendorff's alpha (e.g., Boesso & Kumar, 2007), Cohen's kappa (e.g., Hooghiemstra, 2010), and Leigh's lambda are used to test for inter-coder reliability (for more details, see Milne & Adler, 1999).

The third form of reliability is internal consistency. Litwin (1995, p. 21) describes internal consistency as 'an indicator of how well the different items measure the same issue. This is important because a group of items that purports to measure one variable should indeed be clearly focused on that variable'. For example, Hassan et al. (2009), Cormier et al. (2010), and Elshandidy and Shrives (2016) use Cronbach's alpha, which is a measure of inter-

item correlation, to assess the internal consistency of their measures of disclosure. Cheng and Courtenay (2006) compute pairwise parametric and non-parametric correlations between all the components of their disclosure index to assess internal consistency. Similarly, Kelton and Yang (2008) assess the correlation between the categories of their internet financial reporting index.

The low level of reliability testing identified within our review is consistent with research by Beattie and Thomson (2007), who report that reliability issues do not appear to be addressed in most intellectual capital disclosure studies which they examined. Reliability tests are mainly performed in studies that use a disclosure index and manual textual analysis. These types of disclosure measures are susceptible to coder error and judgement. However, many studies with no apparent reliability testing use a disclosure index or other variables obtained from company disclosures. Other measures of disclosure are based on third-party data with less room for coder error and judgement, such as market-based measures of disclosure. We recommend that researchers should consider the importance of conducting reliability tests of disclosure measures in future studies, when measures of disclosure are subject to coder error and judgement.

3.2.2 Validity Assessment

Validity is defined as 'the extent to which any measuring instrument measures what it is intended to measure' (Carmines & Zeller, 1979, p. 17). There are three common types of validity scrutinised in disclosure studies: content, criterion, and construct.

The first type of validity is content validity. This is assessed by seeking subjective opinions or judgements from non-experts and/or professionals (hence some refer to it as face

validity) about how well the instrument measures what it is intended to measure. In our systematic review, we find that most cases of content validity testing are conducted in disclosure index and textual analysis studies. Not surprisingly, these studies use measures of disclosure that are subject to judgement; hence the authors seek reassurance about the face validity of their measurements of disclosure. A typical example is Patelli and Prencipe (2007), who explain that the inclusion of an item in their disclosure checklist is based on a prior study and is subject to amendment to suit the country in the investigation. They then consult with three experienced auditors and three financial analysts to test its suitability for the Italian setting that they are examining. However, this type of validity is never seen as sufficient when concluding about the validity of a measure. This may be because of concerns about users' perceptions regarding their own use of the information (Dhaliwal, 1980).

Criterion validity is a measure of how well one instrument compares with another instrument or "predictor" (Litwin, 1995, p. 37). Criterion validity assesses if there is a significant correlation between a measure and an external criterion (a desirable outcome). The higher the magnitude of the correlation coefficient, the more valid this instrument or measure is for this criterion. There are two types of criterion validity: concurrent and predictive. The difference between them is the time horizon considered: concurrent validity concerns the correlation between a measure and the criterion at the same time, whereas predictive validity concerns the correlation between a future criterion and the relevant measure. For example, Boesso and Kumar (2007) test the criterion validity of their measure of voluntary disclosure by correlating the number of observations on social perspectives obtained through their textual analysis with the number of awards received by the company. They argue that the greater the emphasis of a company on social activities, the greater the

likelihood of being recognized in the form of awards for stakeholder communication by independent evaluators. Grüning (2011) and Ernstberger and Grüning (2013) provide another example where their measures of disclosure correlate negatively with measures of information asymmetry, that is the desired outcomes of enhanced disclosure is to reduce information asymmetry. However, criterion validity is less likely to be used when assessing the validity of social science measures. This is because most social science measures represent theoretical concepts for which there are no known criterion variables available for comparison. The more abstract the concept, the less likely one is to discover an appropriate criterion for assessing a measure of it (Carmines & Zeller, 1979, p.20). Therefore, it is not surprising that in our systematic review we find relatively few examples of this test among the studies considered.

In contrast to both content validity and criterion validity, construct validity has generalized applicability in the social sciences. 'It is concerned with the extent to which a particular measure relates to other external measures consistent with theoretically derived hypotheses concerning the concepts (or constructs) that are being measured' (Carmines & Zeller, 1979, p. 23). Therefore, testing for the construct validity of a measure of disclosure involves three steps: (i) to specify the links between the measure of disclosure and some theoretically related external variables, (ii) to test this theoretical links empirically, and (iii) to explain how the empirical evidence clarifies the construct validity of the measure of disclosure, which requires a pattern of consistent findings with prior studies. For example, Blanco et al. (2014) examine the association between their measure of the quantity of segment disclosure and common control variables, such as firm size, firm age, profitability, and leverage, and obtain results that are largely consistent with prior studies, to provide

evidence on the construct validity of their measure of disclosure. Additionally, according to Weber (1990, p. 19), 'a measure has construct validity to the extent that it is correlated with some other measures of the same construct¹³', provided that these measures are proven to be reliable and valid measures of that construct. For example, Ernstberger and Grüning (2013) show that their measure of disclosure has construct validity with respect to other disclosure rankings; its association with the AIMR rating, Standard & Poor's transparency disclosure score and other rating methods is significant.

Although in our systematic review we find some evidence of validity testing, future researchers should carry out validity tests as a matter of course, otherwise the link between their proposed measures and corporate financial disclosure might be wrong or misleading. Overall, Table 6 shows that both the disclosure index and textual analysis methods are heavily scrutinised for their reliability and validity as measures for financial disclosure, which justifies more reliance being placed on these measures of disclosure in future studies.

4. DISCUSSION AND RECOMMENDATIONS

The framework for disclosure measurement developed in this study identifies two approaches: (i) a disclosure-based approach that focuses on investigating actual disclosure, operationalizes the concept of disclosure by disaggregating it into its main dimensions such as the quantity and quality of disclosure, and develops methods to measure them, such as the disclosure index and textual analysis, and (ii) a non-disclosure-based approach that deals with disclosure as a latent (unobservable) variable that we indirectly observe through the values of another observable variable(s). These non-disclosure observable variables can be

¹³ In our view, this definition of construct validity could be seen as a narrower application of the former, as Weber limits the potential external variables to other measures of the same construct only.

further classified into formative variables and reflective variables, depending on whether the measure is a determinant or a consequence of disclosure. Our systematic review shows that most prior studies tend to use disclosure-based measures rather than non-disclosure-based measures when investigating disclosure. This is because disclosure-based measures have concrete links to actual disclosure and their reliability and validity can be extensively assessed – as in prior studies. Additionally, most measures of disclosure uncovered in our review are discrete. Discrete measures can be bivariate (0/1 dummies) or multivariate (e.g., disclosure index). Some non-disclosure-based measures are continuous (e.g., market liquidity). However, most disclosure proxies merely rank companies relative to each other, that is, there is no true zero point. Thus, these measures do not possess the characteristics of a ratio scale, but at best only possess the characteristics of an interval scale. Other measures are merely ordinal. Whether a measure is discrete or continuous is important because it impacts the type of econometric analysis that can be employed on the data.

We find that traditional methods for measuring disclosure through direct investigation of a disclosure vehicle such as the disclosure index method continue to dominate the literature, with the classification approach being particularly popular. This prevalence seems to be motivated by ease of coding and the ability to consider large samples. However, the classification approach only sorts companies into mutually exclusive groups with no attempt to study variations in the disclosure attribute within each group. To the best of the authors' knowledge, no new methods are observed that investigate a disclosure vehicle directly, but new directions in the application of automated textual analysis are observed. For example, Grüning (2011) uses VSM, a supervised machine learning tool, to analyze phrases rather than words and to replicate human coding, while Brown and Tucker (2011) use VSM to measure

document similarity. Further developments in the artificial intelligence area are expected to induce improvement in automated textual analysis by providing different units for investigation and new directions of analysis. For example, the application of the concept of deep learning in natural language processing could enhance machine coding of textual sentiment analysis and eliminate human involvement (e.g., Araque, Corcuera-Platas, Sánchez-Rada, & Iglesias, 2017; Chen, Xu, He, & Wang, 2017b). However, automated textual analysis methods will never replace careful and close reading of texts given the complexity of language and research interests in both the intended and unintended information conveyed by the text (Grimmer & Stewart, 2013; Loughran & McDonald, 2016). Another common feature of traditional methods is that they focus on individual items of information, key words or phrases rather than the inter-relationship between them. New visualization methods in qualitative data analysis software, such as tag clouds, tree maps, cluster analysis, and word trees, will help researchers to see the patterns and connections in their data and gain more insight about the disclosures.

The non-disclosure-based measurement approach considers a range of observable variables that are related to financial disclosure, such as market-based measures. The non-disclosure-based measures are used to reflect on the different dimensions of financial disclosure such as its quality and quantity. The measures are relatively less labor-intensive for researchers because these they do not require detailed analysis and coding of the disclosure instruments. Data are mostly retrieved and coded from databases, thus enabling the usage of large-scale samples. This may be a pragmatic response to the preference given to large samples by US-based journals. However, the link between these observable variables and financial disclosure may be weak or bidirectional, thus they should be treated with caution.

In addition, an estimation model that involves these variables is likely to suffer from endogeneity bias for different reasons such as reduced-form research design.

We also discuss some empirical challenges related to causal claims and the reliability and validity assessment of measures of disclosure. To make a causal claim between a measure of disclosure and other observable variables, a full theoretical causal path must be grounded in theory and properly examined using suitable econometric methods. However, the theoretical link between disclosure and other observable variables might be weak or bidirectional and the research model might be susceptible to endogeneity bias. If endogeneity exists, scholars must deal with it, otherwise their results cannot be interpreted. Antonakis et al. (2010) provide an excellent review of the different sources of the endogeneity problem and present methods that allow social scientists to test causal claims in non-experimental settings where randomization is not possible. In addition, the Granger causality test might statistically help to detect the direction of causation (Gujarati, 2010) for temporal data, but the results of this test are sensitive to the number of lags included. While there are some attempts to discuss sources of endogeneity bias in accounting research in general (e.g., Larcker & Rusticus, 2010; Tucker, 2010; Peel, 2016; Gow et al., 2016; Leuz & Wysocki, 2016) to date, a comprehensive review of causal claims in corporate financial disclosure literature is lacking. Due to the gravity of this issue and how false inferences from empirical studies could impact business practice and policy formulation at firm level and national and international levels, future research might consider reviewing causal claims in prior empirical financial disclosure studies and their methodological rigor.

Finally, we document a low level of reliability and validity testing within papers identified in our systematic literature review. Reliability and validity tests are mainly

performed in studies employing either textual analysis or the disclosure index method to measure disclosure. Furthermore, these two methods have the advantages of being disclosure-based and flexible measures of disclosure; hence they could be considered superior to other measures of disclosure. However, 'reliability' and 'validity' are typically perceived as inversely related (Deffner, 1986). For instance, while human coding shows greater validity because coding can be linked to the underlying construct, it is subject to judgement and coding errors which could reduce its reliability. Therefore, while validity assessment will continue to be essential for all measures of financial disclosure in future research because they are developed to measure a construct that cannot be measured directly, reliability assessment will only be an issue for the measures that are subject to coders' judgment and errors. In addition, researchers should be cautious because validity is context-specific, that is what could be a valid measure for corporate financial disclosure in one context might be invalid in a different context.

A current phenomenon of research into corporate financial disclosure is that it often fails to state explicitly the dimension of disclosure it is investigating (e.g., quantity, quality, tone, prominence, etc.). This is problematic because different measures of disclosure may only be appropriate for investigating specific dimensions of disclosure. For example, while textual analysis could be a suitable method to measure the extent of disclosure, a classification method would be more suitable to examine the prominence given to certain disclosures. Additionally, different inferences can be drawn about different dimensions of the same type of disclosure. For example, some prior studies use disclosure quantity (e.g., Cheung et al., 2010; Mouselli et al., 2012) as a proxy for disclosure quality, although the quantity and the quality measures may lead to different rankings for one sample of companies. In addition,

the concept of disclosure quality is subjective and what constitutes quality is still a research question (e.g., Core, 2001; Botosan, 2004; Beattie et al., 2004). Also, more disclosure (quantity) can come at the cost of quality if it hinders readability and increases complexity. Therefore, future researchers should be explicit about the exact dimension(s) of financial disclosure they are investigating and whether the measure of disclosure being employed is, in fact, measuring what it seeks to measure. Additionally, some methods or measures of disclosure are limited in their scope (either numbers or texts) such as textual analysis which focuses on analyzing texts, whereas properties of reported earnings approach focus on accounting numbers only. Therefore, inferences obtained from such metrics should be qualified to reflect their limitations. Furthermore, prior studies have tried to develop proxies for the different dimensions of financial disclosure such as transparency, complexity, quantity, quality, tone, etc. However, a comprehensive list of the necessary and sufficient dimensions of disclosure is lacking, which future research might seek to develop.

Whether a measure of disclosure can be used to assess voluntary or mandatory disclosure is another issue that a researcher needs to consider. Most disclosure-based measures have the flexibility to be applied to different types of disclosure. However, while manual coding can possibly account for different types of disclosure being studied, machine coding is less able to distinguish between the two types of disclosure based on a search of some key words or targeted phrases. This problem can be mitigated if the document is only covering one type of disclosure. On the other hand, some measures are linked to a specific type of disclosure such as the properties of reported earnings, which relate to financial reporting regulations. Others, such as a disclosure survey (Beyer et al., 2010), can capture both voluntary and mandatory disclosures. Therefore, future researchers should be clear

about their choice of disclosure measure and consider whether it is solely identifying the specific type of disclosure they aim to measure.

Another related issue to consider is the time orientation of information disclosure, that is whether it is historical information, concurrent information or forward-looking information. Some measures of disclosure can be used to reflect on these different aspects of disclosure such as the disclosure index and textual analysis methods. Other measures of disclosure can only reflect on a specific type of information. For example, attributes of management forecasts are measures for forward-looking information, while properties of reported earnings are reflecting on historical information. Thus, understanding the time orientation of information disclosure is important to define a suitable measure for disclosure. Additionally, the content of disclosure could vary, which might cause different proxies of the same attribute of the same type of disclosure to behave differently in empirical analysis. For example, Francis et al. (2008) find that various measures of the level of voluntary disclosure (self-constructed disclosure index, management forecast behavior, press releases, conference calls) do not produce consistent results in their relations with earnings quality and cost of capital. They suggest that these different measures of the extent of voluntary disclosure are likely to capture different forms of voluntary disclosure (forward-looking information supplied by management; contemporaneous discussion of results in conference calls; an overall index of voluntary disclosure in mandatory filings) that have different content and are likely to be motivated by different managerial incentives.

Given the several aspects of financial disclosure that are at play, and the considerable number of measures of financial disclosure identified in our paper, there is a scope for further research into how the different measures, all other things being equal, compare with one

another. It would be interesting to obtain or calculate as many proxies of disclosure as possible for a carefully selected sample of companies. Analysis could then be carried out to see how the different proxies compare in one period and over time. Future research might also investigate the interactions between the different dimensions, the different time orientation and the different types of disclosure, their determinants and consequences, and how they compare. For example, how does the quality of concurrent voluntary disclosure compare to the quality of forward-looking voluntary disclosure? And which one is better able to explain changes in firm value for example, and why? How does the tone or complexity of concurrent voluntary disclosure compare to that of concurrent mandatory disclosure? Which type of information disclosure tends to be more complex and why?

To conclude, the concept of corporate financial disclosure is inherently complex. Corporate financial disclosure has different types (mandatory and voluntary), different vehicles (e.g., company reports, conference calls and press release), different time orientations (e.g., historical data, concurrent data, forward-looking data), different dimensions (e.g., quality, quantity, tone, and prominence), and different formats (e.g., numbers and texts). The different aspects of corporate financial disclosure are probably impossible to unequivocally and conclusively determine. Consequently, all measurement, to some extent, is inevitably subjective and partial. This paper identifies 11 common measures of disclosure that a researcher can choose from depending on the purpose of study, data availability and economic factors in terms of time, effort and money needed to develop a measure of disclosure. However, more work is needed to develop innovative and diverse research methods that can capture the richness of the concept of financial disclosure. New methods need not be sophisticated if simple methods can address the research question(s).

Scholars introducing new methods to the literature should explain them in detail to make their results replicable.

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Table 1. Measures for disclosure identified in previous review articles

	Marston and Shrives (1991)	Jones and Shoemaker (1994)	Healy and Palepu (2001)	Beattie et al. (2004)	Beyer et al. (2010)	Leuz and Wysocki (2016)
Type of Disclosure	Mandatory, Voluntary	Thematic analysis of narratives in annual reports, etc.	Voluntary	Narratives in annual reports	Voluntary, mandatory, quality	Mandatory, voluntary, quality
Methods /Measures Identified	Disclosure index	Characters, words, lines, sentences, paragraphs, themes, whole documents	Self-constructed measures (disclosure indices)	Semi-objective: Textual analyses – thematic content analysis Disclosure index studies	Natural language processing technologies Self-constructed indices	Text-based measures Disclosure index
			AIMR scores (analysts' ratings)	Subjective – usually analysts' ratings	AIMR scores	AIMR scores
			Management forecasts		Management forecasts and conference calls	Specific disclosures such as management forecasts, conference calls and segment disclosures
					Properties of reported earnings	Properties of reported earnings
						Binary indicators and frequency of disclosures.

Table 2. Information about the sample of studies used in the systematic review

This table shows a break-down of the 280 papers covered in this review by journal.

Journal	Number of papers	%
The Accounting Review	45	16.07
Journal of Accounting and Economics	40	14.29
Journal of Accounting Research	31	11.07
The International Journal of Accounting	26	9.29
Review of Accounting Studies	22	7.86
Contemporary Accounting Research	19	6.79
Journal of Accounting and Public Policy	19	6.79
European Accounting Review	17	6.07
Accounting Horizons	16	5.71
The British Accounting Review	15	5.36
Journal of Accounting, Auditing and Finance	9	3.21
Abacus	7	2.50
Journal of Business Finance and Accounting	6	2.14
Accounting and Business Research	3	1.07
Accounting, Organizations and Society	2	0.71
Accounting Forum	1	0.36
Accounting, Auditing and Accountability Journal	1	0.36
Critical Perspectives on Accounting	1	0.36
Total	280	100

Table 3. Common proxies for financial disclosure

This table shows the extent of commonly used measurements for disclosure in prior studies and provides some exemplars.

Measurement	Approach	Count	%	Exemplars
Classification approach	DB	112	30.19	Bowen, Davis, and Matsumoto (2005); Marquardt and Wiedman (2007); Hollander, Pronk, and Roelofsen (2010); Gillan and Panasian (2014); Cannizzaro and Weiner (2015).
Disclosure index	DB	50	13.48	Dargenidou, Mcleay, and Raonic (2006); Guedhami and Pittman (2006); Hodgdon, Tondkar, Adhikari, and Harless (2009); Han, Kang, and Yoo (2012); Melis, Gaia, and Carta (2015); Mangena, Li, and Tauringana (2016).
Disclosure count	DB	36	9.70	Debreceeny and Rahman (2005); Bergman and Roychowdhury (2008); Lu, Richardson, and Salterio (2011); Fu, Kraft, and Zhang (2012); Kirk and Vincent (2014); Brochet, Naranjo, and Yu (2016).
Properties of reported earnings	DB	34	9.16	Wang (2006); Altamuro and Beatty (2010); Chen, Hope, Li, and Wang (2011); Kim and Venkatachalam (2011); Koh, Rajgopal, and Srinivasan (2013); Filip, Labelle, and Rousseau (2015).
Sentiment analysis	DB	34	9.16	Kothari, Li, and Short (2009); Li (2010b); Bamber, Hui, and Yeung (2010); Rogers, Van Buskirk, and Zechman (2011); Kravet and Muslu (2013); Yekini, Wisniewski, and Millo (2016).
Textual analysis	DB	31	8.36	Boesso and Kumar (2007); Abraham and Cox (2007); Grüning (2011); Brown and Tucker (2011); Miihkinen (2012); Filzen and Peterson (2015)
Attributes of management forecasts	DB	29	7.82	Yang (2012); Bonsall, Bozanic, and Fischer (2013); Cole and Jones (2015); Kitagawa and Okuda (2016); Zuo (2016).
Regulatory change that affects disclosure	NDB	21	5.66	Zhou (2007); Leuz, Triantis, and Wang (2008); Wang (2010); Arping and Sautner (2013); Bonaimé (2015); Cho (2015).
Market-based measures	NDB	10	2.70	Ascioglu, Hegde, and McDermott (2005); Rogers (2008); Rogers and Van Buskirk (2009); Reeb and Zhao (2013).
Disclosure surveys	NDB	7	1.89	Nikolaev and Van Lent (2005); Daske and Gebhardt (2006); Brown and Hillegeist (2007); Huang and Zhang (2012); Glaum, Baetge, Grothe, and Rster (2013).
Use of GAAP (e.g., US GAAP or IFRS) to indicate higher disclosure	NDB	7	1.89	Van Tendeloo and Vanstraelen (2005); Lapointe–Antunes, Cormier, Magnan, and Gay-Angers (2006); Wan-Hussin (2009); Frino, Palumbo, Capalbo, Gerace, and Mollica (2013).
Total number of common proxies of disclosure		371*	100	

*. Some studies use more than one measure of disclosure, therefore the total number of measures of disclosure employed in prior studies exceeds the number of studies covered in our systematic review, that is 280 studies. DB (NDB): disclosure-based (non-disclosure-based) measurement approach.

Table 4. Summary of common disclosure-based measures of financial disclosure

This tables provides a summary of common disclosure-based measures of corporate financial disclosure covered in this review. It shows how each measure reflects on a specific dimension(s) of disclosure and the common pros and cons. It also shows whether the measure of disclosure is discrete or continuous which can impact the type of econometric analysis that can be employed.

Measurement	Dimension of disclosure	Type of variable	Main Strengths and weaknesses
Classification approach	It is used to measure different dimensions of disclosure	Discrete	<i>Pros.</i> The approach is flexible and can be applied to different types and dimensions of disclosure. It can capture one type of disclosure at a time. It is easy and economical to use in terms of the time, effort and money consumed, and can be applied to large samples. <i>Cons.</i> It merely classifies the data to mutually exclusive categories without any attempt to capture differences in the dimension of disclosure among the members of the same group. Coding could be subjective, and hence results could be difficult to replicate, compare and generalize.
Disclosure index	It is typically used to measure the quantity and/or quality of disclosure	Discrete	<i>Pros.</i> The measure fits the project well. The method is flexible and can be applied to different types of disclosure. It can also capture one type of disclosure at a time. <i>Cons.</i> Self-constructed disclosure index is a subjective method for measuring disclosure, hence the results are hard to replicate and generalize. It is also a labor-intensive and time-consuming method which results in utilizing small samples.
Disclosure Count	It is commonly used to measure disclosure quantity	Discrete	<i>Pros.</i> The approach is flexible and can be applied to different types of disclosure. It is easy and economical to use in terms of the time, effort and money consumed, and can be applied to large samples. <i>Cons.</i> It merely counts the number of disclosures being made without any attempt to investigate their content or context. It could also be driven by different managerial incentives other than facilitating communication with external providers of capital.
Properties of reported earnings	They are usually used to measure the quality of financial reporting	Discrete or continuous	<i>Pros.</i> Both continuous and discrete proxies for disclosure can be constructed. Coding is relatively easy and time-efficient and can be used for large-scale samples. Measures can facilitate consistent measurement across firms. <i>Cons.</i> The quality of financial reporting is not limited to accounting quality only. Different properties of reported earnings may capture different dimensions of quality (Berger, 2011). Other disclosure activities that could serve as a substitute or a complement.
Sentiment analysis	It is usually used to measure the tone of financial disclosure	Discrete or continuous	<i>Pros.</i> The approach is flexible and can be applied to both quantitative and qualitative financial information. It is easy and economical to use with quantitative data and can be applied to large samples. Both continuous and discrete measures for disclosure can be constructed. <i>Cons.</i> The approach is inevitably subjective. While quantitative data can be distorted, textual sentiments can be driven by different managerial incentives such as management reputation.
Textual analysis	It is frequently used to measure the quantity and quality of disclosure	Discrete	<i>Pros.</i> The approach is flexible and can be applied to different types of disclosure. Automated textual analysis is particularly easy and economical to use in terms of the time, effort and money consumed, and can be applied to large samples. <i>Cons.</i> The use of key words does not provide a sound unit of analysis. Using inappropriate or insufficient key words could lead to over- or underestimation of disclosure level. In addition, coding based on a pre-defined list of words that is developed in isolation of actual disclosure texts may not be able to fully capture the construct under investigation, which limits the validity of the constructed measure of disclosure.

Attributes of management forecasts	They are traditionally used to measure the quantity and quality of voluntary disclosure for the US market.	Discrete or continuous	<p><i>Pros.</i> Both continuous and discrete measures for disclosure can be constructed. Coding is relatively easy and time-efficient and can be used for large-scale samples.</p> <p><i>Cons.</i> Management forecasts are relatively less comprehensive measures of disclosure and they could be subject to earnings management, which would affect the quality of these forecasts as measures of disclosure.</p>
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Table 5. Summary of common non-disclosure-based measures of financial disclosure

This tables provides a summary of common non-disclosure-based measures of corporate financial disclosure covered in this review. It shows how each measure reflects on a specific dimension(s) of disclosure and the common pros and cons. It also shows whether the measure of disclosure is discrete or continuous which can impact the type of econometric analysis that can be employed.

Measurement	Dimension of disclosure	Type of variable	Main Strengths and weaknesses*
<i>Formative measures</i>			
Regulatory change that affects disclosure	It is often used to proxy for a change in the quantity or quality of disclosure	Discrete	<i>Pros.</i> The approach is easy to use and economical in terms of time, effort and money consumed in constructing a proxy for disclosure. <i>Cons.</i> The variable merely indicates a change in disclosure, with no attempt to measure the size of that change. There is no attempt to assess actual level of compliance with the regulatory change, which could be problematic, particularly in the absence of strong enforcement policies.
Voluntary use of GAAP (e.g., US GAAP or IFRS) to indicate higher disclosure	It is generally used to proxy for higher level of disclosure quantity and/or quality	Discrete	<i>Pros.</i> It is a relatively easy and time-efficient variable to construct and can be used for large-scale samples. <i>Cons.</i> It only divides the sample into two mutually exclusive groups where actual disclosure can still differ among the members of the same group.
<i>Reflective measures</i>			
Market-based measures	They are frequently used to proxy for the quality of disclosure	Discrete or continuous	<i>Pros.</i> These measures are easily obtainable from databases and can be used for large samples. Also, they can be constructed using both discrete and continuous variables. <i>Cons.</i> However, these measures usually suffer from a lack of theoretical casual path linking them with disclosure and are likely to be noisy measures of disclosure.
Disclosure surveys	They are usually used to proxy for disclosure quantity and quality	Discrete	<i>Pros.</i> Disclosure scores are ready-made by professional analysts and can be obtained for sizable samples. <i>Cons.</i> The scores reflect analysts' perceptions about firms' disclosure policies, rather than direct investigation of actual disclosure practices. Analysts' ratings are profoundly geared towards large firms. This approach is subject to measurement bias because the disclosure score created could capture not only the disclosure practice of a company but also its fundamental characteristics and performance.

*These measures share some common cons such as a reduced-form research design and their relationship with disclosure could be bidirectional.

Table 6. The extent of conducting reliability and validity tests in prior studies

This table shows a list of the studies that have conducted some sorts of reliability and validity testing on their measures of disclosure, so studies that have not explicitly done so are not listed in this table.

Test	Disclosure Index	Textual analysis/ <i>Textual Sentiment Analysis</i>	Other Measures of Disclosure
Test-retest	Al-Akra and Ali (2012).	Boesso and Kumar (2007).	
Inter-coder reliability	Owusu-Ansah and Yeoh (2005); Cheng and Courtenay (2006); Al-Shammari, Brown, and Tarca (2008); Cheung et al. (2010); Cormier, Aerts, Ledoux, and Magnan, (2010); Melis et al. (2015); Mangena et al. (2016).	Linsley and Shrives (2006); Abraham and Cox (2007); Boesso and Kumar (2007); <i>Hooghiemstra (2010)</i> ; Miihkinen (2012); Chen et al. (2017a).	Adhikari and Duru (2006); Carcello, Hollingsworth, and Neal (2006); Entwistle, Feltham, and Mbagwu (2006); Hollander et al. (2010); Plumlee and Yohn (2010).
Internal consistency	Cheng and Courtenay (2006); Lapointe–Antunes et al. (2006); Kelton and Yang (2008); Cormier et al. (2010); Hassan et al. (2009).	Abraham and Cox (2007); Elshandidy et al. (2015).	
Content validity	Akhtaruddin (2005); Owusu-Ansah and Yeoh (2005); Cheng and Courtenay (2006); Lim et al. (2007); Orens and Lybaert (2007); Patelli and Rencipe (2007); Al-Shammari et al. (2008); Francis et al. (2008); Webb et al. (2008); Çürük (2009); Hodgdon et al. (2009); Sutthachai and Cooke (2009); Al-Akra, Eddie, and Ali (2010a; 2010b), Melis et al. (2015); Bazrafshan et al. (2016).	Linsley and Shrives (2006); Abraham and Cox (2007); Boesso and Kumar (2007); <i>Feldman, Govindaraj, Livnat, and Segal (2010)</i> ; <i>Sun (2010)</i> ; Miihkinen (2012); <i>Merkley (2014)</i> ; Brochet et al. (2015).	Plumlee and Yohn (2010).
Criterion validity	Melis et al. (2015).	Boesso and Kumar (2007); Grüning (2011); Ernstberger and Grüning (2013).	Beneish, Billings and Hodder (2008).
Construct validity	Cheng and Courtenay (2006); Lapointe–Antunes et al. (2006); Guedhami and Pittman (2006); Patelli and Rencipe (2007); Francis et al. (2008); Mangena et al. (2016).	Li (2010b); Brown and Tucker (2011); Grüning (2011); Ernstberger and Grüning (2013); <i>Kravet and Muslu (2013)</i> ; <i>Blanco, Lara, and Tribó (2014)</i> ; Brochet et al. (2015); Chen, et al. (2015); Elshandidy et al. (2015); Filzen and Peterson (2015).	Gu and Li (2007); Wang (2007); Files (2012).

*. These include classification approach, disclosure count and market-based disclosure measures. References in italic are examples of textual sentiment analysis.