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Użyteczność rocznych raportów finansowych dla inwestorów

The Relevance of Audited Annual Financial Reports for Investors

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ABSTRACT

Financial accounting research is one of the disciplines in which the improved abilities to analyze unstructured textual data manifest themselves, with particular emphasis given to narrative attributes of financial texts.

This study sets to utilize said abilities to analyze complex corpora of text in order to measure the relevance of audited annual financial reports for investors. It does so by assessing the exact manner in which investors are using these reports in practice, thus, measuring investors' reactions to report publication and assessing the report impact on investors' behavior. This study suggests an integrative approach in which accounting disciplines are crossed with linguistic techniques to create a new approach for measuring accounting related (narrative) texts.

The empiric data used in this study was retrieved from the NASDAQ stock exchange, during the decade spanning between years 2005-2015. This data includes all annual Form 10-K reports (which public firms trading on US exchanges are regulated to issue by the US Securities and Exchange Commission) published in this decade, and all daily stock movements observed in the same time-frame. The framework suggested in this study deal with the concept of measurement, applied on both information (reports) and reaction (stocks movements). This framework enables measuring annual Form 10-K reports information via text analytics, and measuring investors' reactions via trade movements (price/volume) and volatility.

Conclusions presented in this study show that there is a clear trend in which annual Form 10-K reports are growing complex and hard to read with years, and that these attributes are especially strong among reports audited by first-tier auditors. Additionally, this study shows that on the short-term, investors react specifically to the publication event, while the content of the report comes to significance only at the long-term. This study also discusses the potential benefits which may be extracted from understanding the exact response patterns and relations of investors to reports' publication.

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Finally, an honorable mention goes to my parents, my wife Shirly and my children, Aviv, Yamit and Ofir, for their understanding and support during this long endeavor.

AUDITOR'S DECLARATION

This work was done wholly while in candidature for a research degree at Poznan University of Economics, no part of this thesis has previously been submitted for a degree or any other qualification.

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1. CHAPTER I: INTRODUCTION

1.1 PREFACE

The last decade is characterized in several disruptive advancements in both information technology and data related research. Among which, the "Big Data" phenomenon, which is often attributed to the improved abilities of analyzing large sets of "soft", unstructured data[1]. This type of data is usually text-intensive, and does not adhere to a pre-defined specific schema or rules. Tools and methods dealing with unstructured textual data use several techniques, some drawn from the scientific field of language studies (linguistics), such as text analytics or natural language processing, while other techniques are drawn from the field of computer science, such as data mining and machine learning.

Both accounting and finance related research conducted within the last decade were influenced in great extent from the mentioned "Big Data" phenomenon[2]. Since information residing in formal records of financial activities is text-intensive, and key elements as annual financial reports are narrative in nature, the improved abilities in analyzing unstructured textual data have therefore been manifested in accounting related research. A distinct trend in which emphasis is given to the narrative attributes of financial texts in general, and annual reports in specific is one of the indicators for the growing popularity of text related research articles published within the accounting discipline [Asthana and Balsam, 2001; Griffin, 2003a; You and Zhang 2009].

Usage of concepts from disciplines as linguistics and computer science in accounting related research presents growing interest not just among researchers but also among industry-related parties, such as firms, investors, auditors and regulating authorities.

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[1] Retrieved from Mckinsey Global Institute Report "Big data: The next frontier for innovation, competition, and productivity", May 2011

[2] Retrieved from Ernst & Young report, "Financial Reporting Developments - Accounting changes and error corrections", May 2015

Traditionally, accounting related research has attributed a great extent of attention toward quantitative figures [Tetlock et al., 2008]. The enablement of quantitative research based on free-text (traditionally qualitative) offers new possibilities and options for accounting related research. In accordance, research studies at the current decade [Balakrishnan et al., 2010; Dalal et al., 2011; Novak, 2011; Miner et al., 2012; Doucette and Cohen, 2015] use various techniques allowing quantitative measurements over large datasets of unstructured texts (which, as mentioned, are abundant in annual accounting information).

1.2 CONTEXT OF THIS STUDY

Financial statements are among the most common tools firms use to deliver information. The objective of these statements is to "provide information about the financial position, performance and changes in financial position of an enterprise"[3]. Said information is provided to any type of entity (as investors, analysts) interested in making educated decisions based on the information. Compared to basic types of financial statements (balance sheet, income statement, changes in equity and cash flow), annual reports are usually more elaborated [Griffin, 2003a], and may contain additional sections and information such as corporate information, accounting policies, director's report, auditor's report, chairperson's statement, operating and financial review.

Public firms trading at the US (which this study specifically targets) usually issue two types of annual reports [Freed and Sommer, 2014]. The first, an annual shareholders report, which is relatively short, representative and well designed, is sent to shareholders and is not part of any regulatory obligation. The second type of annual report is the Form 10-K, which is a designated file of the US Securities and Exchange Commission (SEC). This type of report is mandatory for public firms, and is regulated to be transmitted to stock exchanges via EDGAR, which is the proprietary information system SEC operates for tasks

[3] Retrieved from "The framework for the preparation and presentation of financial statements of the international accounting standards board", June 2007.

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of documents (statements, reports or announcements) transmission and retrieval (see elaboration on Form 10-K filings at the [Terms](#) section).

Studies [Gigler and Hemmer, 1998; Lev and Zarowin, 1999; Griffin, 2003b; Ormiston and Fraser, 2013; Singleton and Swindle, 2015] dealing with the concept of financial reports usefulness, examine methods in which investors can scrutinize the reports for valuable information and insights. These studies relate to the concept of usefulness as the potential benefit that financial reports may have for investors.

However, it may be argued that the requirements investors face in order to get the mentioned usefulness are quite demanding. Several immediate questions arise when specifically examining Form 10-K reports: how do investors cope with reading hundreds of pages for a single publication[4]? how do investors cope with reading all the reports for a specific industry? how many investors have the financial expertise required in order to understand fully a report? and finally, even if an investor is a financial expert, how can he cope with the demanding task of handling hundreds of Form 10-K reports published in the same day or two[5]?

While using the contextual framework of Form 10-K reports published by firms trading at the NASDAQ stock exchange and their respective stock performance, this study argues that the question is not just how theoretically can investors use financial reports in general and Form 10-K reports in specific, and what is the potential usefulness the latter may present, but rather how investors are actually using them, in practice. Put simply, inquire how do investors use Form 10-K reports in effect, examine which attributes of the reports have an impact on investors, and how does this impact manifest itself.

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[4] Data presented in this study show that on average, an annual Form 10-K report at the examined time-span had a mean word count of 62,629 words and a median of 52,948 thousand words.

[5] Data presented in this study show Form 10-K reports concurrency within 2005-2015 reach peaks of up to 166 same-day publications, and 324 publications in a two days' span.

1.3 RESEARCH OBJECTIVES

This study sets to achieve several key objectives, divided into past and future perspectives:

1. **Assess the relevance of Form 10-K reports for investors:** by using measurements of report's impact on investors' behavior: relating to past events, this study sets to assess reports relevance as it was expressed over the past ten years at the NASDAQ stock exchange. By using measurements of report's impact on investors' behavior, and determining the nature of attributes and factors in which this impact comes to a realization, an estimating annual Form 10-K reports relevance for investors may be achieved successfully.

2. **Offer a better understanding of the market ecosystem:** assess whether there are consistent and significant multi-year trends relating to the different attributes of Form 10-K reports (whether intrinsic as readability and complexity, or external as timing and auditor related), and formulate these trends respective impact on investors.

3. **Relating to future events, this study pursues to answer two key questions:** can the analysis of Form 10-K reports produce additional value for investors which is currently unexploited (hence adding to their relevance) and how can a better understanding of the investor-auditor-company triangle be beneficial for investors.

In order to achieve these objectives, this study uses narrative information (residing at annual Form 10-K reports), thus showing that such textual information can be linked and correlated with impact and investors reaction, and therefore may be used for assessing the relevance of information sources as annual reports to stock market investors.

1.4 RESEARCH QUESTIONS AND HYPOTHESES

The research questions are formulated to answer the objectives of the research. These objectives are pursued by understanding the impacts, effects and characteristics of different

aspects within the market eco-system, and their respective relation to investors, firms and auditors.

In accordance, the following four research questions are formulated, leading in turn for six hypotheses:

Q1: What impact do auditors in general, and auditor-tier (see Term section for elaborated definition) in specific have on the composition and attributes of the Form 10-K report?

Q2: How do Form 10-K reports characteristics change over time?

Q3: How do Form 10-K report publications affect trade volume?

Q4: How do post-publication effects of Form 10-K reports manifest themselves over time?

Following the research questions, hypotheses are formulated:

H1: Form 10-K reports audited by a first-tier ("Big 4") auditor are more complex (have a larger narrative ratio and are longer) and hard to read than reports audited by a non-first-tier auditor.

H2: Form 10-K reports present a consistent multi-year trend in which reports are growing more complex (have a larger narrative ratio and are longer) and hard to read.

H3: Short-term stock performance and its volatility are affected by external attributes of Form 10-K report publications.

H4: Long-term stock performance and its volatility are affected by intrinsic, content related attributes (readability, complexity) of Form 10-K report publications.

H5: Investors' reaction to Form 10-K reports is expressed differently in the short-term and in the long-term.

H6: Complex and less readable Form 10-K report publications have a negative effect on trade volume volatility.

See [chapter 3](#) for elaboration on the hypotheses formulation process and the literature justification for each hypothesis.

1.5 DISSERTATION'S STRUCTURE

This study is conducted under the parent discipline of Finance, with the sub-disciplines of Accounting. The dissertation is made out of the following seven chapters (accompanied by the appendix):

1. **Introduction:** this chapter includes a context of the study, research motivation and purpose, research objectives, research questions and hypotheses.
2. **Literature Review:** this chapter evaluates dominant factors of investor reactions toward annual Form 10-K reports, the impact of presentation timing, publication timeline, regulation and information content on the equity market, dominant features of the auditors' environment and auditors' roles.
3. **Hypotheses formulation**: this chapter includes hypotheses reasoning and formulation in regard to the literature review, over the following topics: audit-tier effects, annual trends, performance effects and trade volume effects.
4. **Theoretical Framework:** this chapter reviews measurements of financial text contents, market reactions measurement theories, investor response measurements, reaction measurements changes caused by events concurrency.
5. **Methodology:** this chapter specifies processes within this study, as data collection (corpus construction and format, corpus population filtering), data processing techniques (combining quotes and publications datasets, calculating volatility, filtering outliers), free-text readability measurements, impact measurements, ranking creation and comparison, clustering.
6. **Results:** this chapter includes a comprehensive reporting of all analysis steps and measures taken, as well as variables definition, variables distributions and relationships, statistical processes and methods, descriptive statistics, inferential statistics, hypotheses testing.

7. **Discussion:** this chapter includes a discussion on the findings, their conformity for research goals, research questions and hypotheses made, alignment of findings with existing literature, implications consideration, addressing research questions, potential/beneficial attributes of results for investors, future use and suggestions for continued research.

8. **Appendix:** this section includes technical issues as EDGAR integration and C# code snippets, as well as histograms and boxplots mentioned at the results analysis, and the effect of the year 2008 crises on data presented in this study.

1.6 UNIQUE ASPECTS OF THIS STUDY

This study employs several techniques and notions which are unique in nature:

Holistic approach: in the process of examining Form 10-K impact and relevance for investors, consideration is also made for external parties (auditors and regulative authorities) influence. As demonstrated, such parties create an indirect influence on investors, by affecting attributes of Form 10-K as readability, complexity, and the load of concurrent reports published at the same time, thus serving different roles, direct and indirect. This holistic approach comes to realization by assessing the impact on investors from two different types: intrinsic and direct, deriving from the report itself, and external, indirect, which is an outcome of concurrent events taking place within the same time frame.

Usage of ranking to compare trade figures: there are several problems deriving from comparing firms in the general firm population without any segmentation. Certain industries may prone for larger performance volatility (as the information technology sector [Choudhary et al., 2014]), while other industries may prove less volatile (for reasons of mature/traditional market, with less changing attributes). As an outcome, different inter-industry reactions may skew results when comparing publication effects. The ranking solution proposed in this study demonstrate that trade related events can be measured by implementing a ranking mechanism (thus, relating to trade figures as ordinal in nature, rather as a ratio scale). This topic is further elaborated in section 5.4.3.

Usage of relative peak proximity measurements: past studies [Asthana and Balsam, 2001; You and Zhang, 2009] mentioned in the literature review examine the influence of Form 10-K reports in relation to publication's peak proximity (indicating the number of days before the regulated deadline on which the firm published the report). Since Form 10-K publications are characterized in three publication peaks (at 60, 75 and 90 days after the beginning of the year), this study measures the peak proximity by the proximity of the publication to the <u>closest</u> publication peak rather than the <u>regulated</u> one. Two firms publishing reports on the same day may have different deadlines (which is determined by the respective public float rate). Therefore, when relating to peak proximity, it is suggested that investors are influenced by the relative peak proximity, and may not be aware of the public float minor differences which dictate different deadlines. This topic is further elaborated in section 5.5.3.

Relevance versus usefulness: this study sets the focus toward actual usage of data and empiric measurements, rather than directing the focus to potential (possible/theoretical) outcomes. By doing so, it assesses the actual relevance of financial texts for investors, rather than estimating the potential the latter has, which may prove in the future not to be fully exploited in practice.

Measuring relative performance in historical perspective: values of a specific stock may be measured in respect not just to other stocks, but also in respect to historical values of the stock itself. Some stocks are volatile by nature, and present high values (in relation to other stocks) routinely. In order to examine the influence of Form 10-K publications on stocks, the registered performance and volume changes are measured not just as a standalone value, but also in respect to historical values of the same stock. For example, two stocks showing a 10% performance growth within 3 days after publication may prove very different, if one is constantly showing this scale of performances (whether positive or negative), while the other traditionally shows very low figures. To address this issue, in addition for calculating performance and volume figures, they are also accompanied with relative volatility figures, showing the change in volatility which values present in relation for the historical values of the specific stock. This measure is obtained using the calculation

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of relative standard deviation (Coefficient of Variation), a standardized measure of dispersion, showing the specific values relation with prior mean and standard deviation of the past values measured on the same stock.

1.7 RATIONALE FOR CHOOSING THIS TOPIC

This scientific goal of this study relate to identifying, understanding and formulating the relevance of annual Form 10-K reports for investors. When setting to determine the importance of this topic, and the necessity for scientific investigation to be conducted, the following two factors should be taken into consideration:

1. Parties of interest: the topic of this study reaches a vast array of entities. From firms to investors, through auditors and regulators, each is assessed and studied (with relation to annual reports), and accordingly may find relevance in this study to their immediate needs, key questions and achieve a better understanding for their environment.
2. The topic of this study and its derivatives have attracted wide-scale academic attention, manifested in articles by top researchers [Easton and Zmijewski, 1993; Asthana and Balsam, 2001; Griffin, 2003a; You and Zhang, 2009] discussed at the literature review of this study.

In accordance, selecting this topic for research is worthwhile studying since is possess both practical value (for market participants and authorities) and theoretical value (for researchers and academics).

1.8 CONTRIBUTION FOR SCIENCE

This study adopts a multidisciplinary approach in which accounting disciplines are crossed with linguistic disciplines (as language processing) and computer science disciplines (as machine learning) to create new methods of measuring accounting related (narrative) texts. By combining techniques from several spheres, synergetic effects create combined abilities for assessing unstructured text in general, and financial aspects of such text in specific.

Using free text analysis of narrative financial text is an outcome of this approach, which (as demonstrated in this study) show a large amount of contribution in assessing reaction to text intensive publications with adequate statistical significance.

The benefits of this study are manifested in several verticals. First of all – better understanding of the market's environment. This not only includes response of investors for annual Form 10-K reports and key factors influencing them, but also relate to multi-year trends, pointing to significant shifts in the market.

Conclusions elaborated in this study contribute for a better understanding of auditors' role and their impact over the market, by showing that auditors carry the significant ability to facilitate changes among major parties (companies and investors) relationships, in both direct and indirect fashion.

Finally, detecting new methods of value creation and reinforcing the relevance of reports has the ability to strengthen the positioning of academic research, by providing valid, actionable value on a practical level, hence linking between business and academic eco-systems.

2. CHAPTER II: LITERATURE REVIEW

This chapter includes a survey of existing literature relevant for this study, which is multidisciplinary in nature: estimating annual reports relevance requires measuring information-supplying parties as auditors and firms, and measuring information-consuming parties (investors, securities analysts) which react to the reports' publications and content. Both topics (information supply and information consumption) are reviewed from several perspectives. Research studies dealing with information supply are examined from aspects of reports composition, readability, complexity and delivery dates. In addition, research studies dealing with information consumption are examined from aspects of reaction measurement, performance, volume and volatility. Reciprocal relations among different parties from both topics are also reviewed in elaboration.

2.1 PREFACE

In order to group research papers by conclusions deriving from their respective studies, while being able to provide sufficient resolution (to enable highlighting of certain studies and criticizing others), the literature review is structured to contain several parts, dealing with auditors, filings, events and information. Reviewing research studies from different years, using different methods and examining various exchanges, allows critical evaluation of research studies, as well as a holistic and broad view of the similarities and conformity among researchers.[6]

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[6] As mentioned at the introduction chapter, while the theoretical framework chapter deals with measurements (of both information and reactions), the literature review is outlining the existing research over the parties themselves (auditors, firms, investors, managers, analysts, regulators). The review includes not only survey participants' related research, but also deals with studies regarding reciprocal connections and relationship between the participants.

Literature reviewed in the first section (dominant features of the auditors' environment) focus on the different types of auditors, and on the influence which auditors have on their clients. A distinction between large and small auditors, and auditor tiers examines the differences in topics such as enforcement of regulation adherence on clients, and the ability to discipline clients toward accurate reporting. In addition, literature relating to investors' perceptions is reviewed, examining cases such as investors treating auditors not just as financial gatekeepers but as business gatekeepers (thus reviewing business decisions). Quality issues are also reviewed, including quality differences between small and large auditors, and between small and large offices of a large auditor.

The first part deals with the immediate, direct environment of auditors. In order to compare research studies conducted over similar parameters, features or characteristics (of the auditors' environment), segmentation of studies categorized the relevant research into several groups.

Methodology: in writing this literature review, particular emphasis was given to the following topics:

- **Research development is dealt with in several aspects:** first, from a timeline perspective, outlaying the advancement of research throughout the past decades. Second, from technological and regulatory aspects, viewing changes in research upon pre and post EDGAR (SEC exchange interface) studies.
- **Selection of sources is spread across exchanges and countries:** in order to provide a wide view for research studies done over non-SEC regulated exchanges (outside the US), studies are included from additional environments, comparing NASDAQ with other global exchanges, both in Europe and the Far East.
- **Critical evaluation:** in order to focus criticism over ideas (rather over specific studies), contradicting conclusions between studies are presented while paying attention to the methodologies studies employ. In some cases, studies that seem to present contradicting conclusions do so when in fact differing on several key attributes (methods or interpretation) which cause the contradiction. As

demonstrated, such attributes may be related to time frames (pre/post regulation) or different investor mix deriving from industry specifics.

- **Recency of studies** has also been a primary factor in writing this literature review. The majority of the studies mentioned are dated to the past ten years. Referring to older studies assists in forming a connection to new studies, thus providing a research flow observation. This also allows highlighting points of disagreement among studies when relating to the time factor[7].

Research studies examined in the literature review deal with the following topics:

- **Roles of the auditor:** looking into the different roles an auditor is required to follow, both external (facing firms or investors) and internal (inter-office knowledge sharing and collaboration). The impact of auditor's roles on products (reports, announcements and information flow) is also reviewed, with particular attention paid to regulation influence on the entire process (from information processing to report publication). In addition, studies which will be examined relate to enforcement attributes of auditors (such as restraining from misconducts) [8].

- **Auditor/client interaction and reciprocal relations**: since the auditor serves as a gateway for investors towards its clients (firms), research focus on reciprocal relations in between the latter. Several studies dealing with the concept of reputation (being a strong indicator of quality) are reviewed in elaboration. Another vertical which is addressed deals with reputation related research (the study of investors' perceptions of quality, in relation to both auditors and clients).

- **Motivations and causes towards a high-quality audit:** relating to different ways in which auditors are incentivized to issue better quality audit reports. As

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[7] 26% of studies referenced in this study were published after 2010. Another 35% of studies referenced were published between 2005 and 2010, 20% of studies referenced were published between 2000 and 2015. The remaining 19% of studies were published before the year 2000.

[8] Certain research verticals are dedicated to the study of roles which are perceived and intangible in nature, such as serving as a safety net for investors [Banimahd and Aliabadi, 2013].

elaborated, certain parameters act as direct incentivizes toward a better audit, while others do so indirectly (as an after-effect).

- **The definition of quality and perceived quality:** making the distinction between two types of quality, the first and the more immediate quality type is perceived quality, or quality as seen by investors. There is another version of quality, one that is measured in hindsight (ex-post) by events as restatements which imply that the original audit lacked quality. Measuring quality in hindsight is argued [Weiner, 2012] to be more robust (in relation to perceived quality which is subject to bias). This notion is addressed in this literature review by examining research conducted on both types of quality, making a distinction between them and formulating each type different characteristics.

- **Auditor/office size impacts**: first-tier auditors dominance in major aspects based on company size or market cap are examined through studies [Ferguson et al., 2003; Francis et al., 2005; Vera-munoz et al., 2006; Francis et al., 2013], which conduct comparisons between the auditor tiers, and reveal several aspects of the audit environment in which tiers differ. In addition, inter-office differences are discussed both from the auditor perspective and from the market perspective.

2.2 DOMINANT FEATURES OF THE AUDITORS' ENVIRONMENT

This section contains a review of the auditors' environment. Apart of their role as reporting facilitators, modern auditors act as mediators between public firms and market investors [Francis and Yu, 2009]. The complex environment in which auditors operate consists of several fluid (intangible) attributes, such as reputation, trust and perceived quality of audits. In addition, auditors act as policy agents, enforcing regulations for both themselves and their clients.

2.2.1 The roles of auditors

The essence of the auditor's role is to provide genuine and bias free financial reporting [Graham et al., 2005]. However, researchers [Boone et al., 2010; Banimahd and Aliabadi,

2013; Bryant-Kutcher et al., 2013] indicate that auditors can possess a profound impact on firms and investors in several ways, and therefore serve additional roles at the market except the reporting role, thus creating their own "auditor-driven" bias.

By grouping the observations made by Graham et al. [2005], Boone et al. [2010], Banimahd and Aliabadi [2013] and Bryant-Kutcher et al. [2013], auditors serve the following roles.

- **Auditing:** an official financial examination of reports, review and inspection of figures and data provided by firms, authoring relevant information, inspection of financial activities.
- **Scrutiny:** restraining firms from misconduct (as earnings management), by rigorous examinations and scrutiny (deterring firm managers from deliberate misrepresentation).
- **Safety net:** protect investors from questionable managerial decisions.
- **Regulation:** auditors are responsible for enforcement and adherence to regulations made by authorities in different levels (exchange specific, local and national).

Taking the critical perspective, it may be argued that these roles are applicable especially when referring to first-tier auditors. Studies indicate [Alford et al., 1993; Dalton et al., 2010] that the enforcement abilities of an auditor are much dependent on the actual ratio of sizes he has in respect to his client - while a large auditor can enforce regulation adherence with a large success over a smaller client, when the opposite situation forms (small auditor, large client) this may not be the case.

Research advancement: auditor scrutiny of clients and the ability of auditors to restrain misconducts as earnings management has been a subject of research from before the deadline acceleration act (2003), and before EDGAR has been put into use (2002) [Nochols and Smith, 1983; Johnson and Lys, 1990; Schwartz and Soo, 1996a; Glass, 2004]. The massive changes deriving both from the regulative perspective (SEC acceleration) and from information dissemination perspective (EDGAR) did not cause a shift or change of paradigm in regard with the auditor role of restraining clients [Boone et al., 2010]. This

can be viewed as indicating a supportive evidence that auditors possess the same extent of enforcement measures as regulations do, when relating to deterring clients from misconducts.

A study by Liang [2000] conclude that "the real value of audited financial information may be that it disciplines other firm reported information". Auditors, incentivized to issue accurate and truthful reports, are likely to block any client attempt for strategic management of announcements, press releases and other non-audited information channels, and make sure the latter are aligned with the true financial status of the firm as reflected within audited information. A later study by Bryant-Kutcher et al. [2013] show that auditor scrutiny can prove quite rigorous and persistent when facing misconducts (such as earnings management) by an audited client. Another study by Boone et al. [2010] conducted over the restraining properties which auditors have on their clients indicate that auditors are restraining earnings management, and by doing so firms are likely to issue reports that better reflect the actual state of the firm[9].

As indicated by Graham et al. [2005], measurement of auditor's impact over business judgment is rather problematic to conduct, and the likeliness of an auditor to second guess economic decisions made by a client is low, since the business judgment is by nature the sole responsibility of the client and is not an auditor's responsibility. As indicated by Banimahd and Aliabadi [2013], a large auditor with a considerable reputation may reflect as a safety net, as perceived in eyes of investors. Taking a different perspective on auditor's influence on business decisions, it may be argued that since investors relate to auditors as restrainers from misconduct, they may also be seen (by investors) as an external quality assurance relating to managers business decisions. Put simply, auditors are perceived by

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[9] Looking at the overall conclusions drawn from the said research papers (which are divided by up to ten years from each other), it may be argued that the restraining role of an auditor is kept consistent throughout the years, and in many aspects is driven to keep doing so by interests of clients and auditors alike.

investors not just as financial gatekeepers, but also as business gatekeepers, although this notion was indicated to be inconsistent by Banimahd and Aliabadi [2013].

Another perspective of the auditor's role (as reflected by investors) relate to information asymmetry. As indicated by both Dye [1993], Titman and Trueman [1986], auditors facilitate market transactions through sharing their professional opinions over financial statements and reports made by firms. In turn, these reports are reducing information asymmetry which exists between firms and investors. Since investors rely on auditors to narrow this information gap [Graham et al., 2005], they treat the auditor as a mediator which not only has access to firm's data, but also bear a commitment towards true, accurate and professional information sharing.

A recent finding by Francis et al. [2013] indicate that while serving the mentioned roles, auditors are facing unique challenges, both from an operational perspective and from a business perspective. Bigger auditors aspire to mitigate uneven quality of reports produced in various sections of the organization, and invest heavily on knowledge sharing practices in order to obtain better consistency [Francis et al., 2013]. It may be argued that since auditor size is expected to grow as the entire industry grows, matures and consolidates, cross-office issues are destined to attract more attention and require resource allocation (so auditors will not just be expected to serve certain roles, but also be required to do so homogenously, across all their branches).

Size differences also relate to the concept of auditor independence as perceived by investors. As indicated by Watts and Zimmerman [1983]: "the size of an audit firm is fundamental to perceived auditor independence because smaller firms are unable to develop appropriate financial resources… to perform an examination of larger clients". This conclusion is aligned with recent research by Weiner [2012], which indicate that the auditor's willingness to report a "breach in protocol" after the latter is discovered is reflected within the auditor independence, and therefore considered an outcome of auditor

size. Hence, it may be argued that smaller auditors do not have sufficient independence in order to issue quality audits of big clients, regardless of their expertise and efforts[10].

2.2.2   Attributes related to auditor's size and their effects

Regulations over public firms with actively trading shares in stock exchanges are extensive and on an incline tendency [Bryant-Kutcher et al., 2013]. Both auditors and firms are subjects of these regulations (whether directly or indirectly). Bryant-Kutcher et al. [2013] indicate that compliance with regulations is better among large auditors than among small ones. This conclusion is aligned with studies published in the pre-EDGAR period [Johnson and Lys 1990] and in the post-EDGAR period [Weiner, 2012], so there is a visible continuity in research regarding this topic.

Taking the critical perspective, it may by suggested that there is a certain amount of stagnation among researchers, and that there is a need to update the composition of features available. The 25 years past the mentioned pre-EDGAR research by Johnson and Lys [1990] consisted of major changes to the environment of firms, auditors and investors, which nowadays contain even more regulations and require larger expertise [Menike et al., 2013]. When referring to Form 10-K reports, accelerated deadlines require auditors to invest more resources in order to complete an audit faster. Being so, regulation adherence research should be conducted while making adjustments as for the changing requirements and resources an auditor should allocate in order to achieve complete adherence. Since as mentioned, regulation nowadays is considered harder to comply, is this compliance harder to accomplish among small auditors? If so, there is a size advantage for auditors in relation to regulation.

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[10] The modern auditor is facing challenges in three different aspects – the first, professional difficulties, relating to size and operations management, the second, relationship with clients, which are kept under strict regulation, and the third, maintaining investors' perceptions.

A study by Dalton et al. [2010] concluded that when audited by one of the first-tier auditors, a firm is more likely to adhere to regulations and provide required filings on time. Therefore, it may be argued that part of the success matching the deadline is simply a matter of auditor expertise and auditor allocated resources, rather than a difference among the public firms (subjects of the reports) or an outcome from firm misconducts. These findings are aligned with reports characteristics studied by Schwartz and Soo [1996b], indicating that quarterly filings are provided more timely when audited by a first-tier auditor, so it may be argued that the auditor capabilities did not change (proportionally) from 1996 [Schwartz and Soo, 1996b] to 2010 [Dalton et al., 2010] despite regulations and technological advancements. However, the research by Dalton et al. [2010] state that "we do not contend a causal relationship between "Big 4" auditors and timely 10-K filings", meaning correlation is found between first-tier auditors and regulation adherence that does not necessarily flow from direct causality, and may be attributed to heterogenic distribution of clients among auditors. This reservation by Dalton et al. [2010] shows advancement in research, acknowledging audit-tier and regulation adherence correlation may not be causal, and may be flowing from another third party source. To put simply, the fact that "Big 4" auditors adhere better to deadlines and regulations may not derive from their intrinsic abilities, but rather from a different client mix they have in respect to non "Big 4" auditors which tend to audit smaller firms [Asthana et al., 2004].

In addition, the mentioned causality may be attributed to external parameters such as higher independence spotted among first-tier auditors. This higher independence was referred to by several studies [DeAngelo, 1981b; Abu Bakar et al., 2005], so it may be argued that the auditor independence is a contributing cause to the increased regulation adherence (thus, auditors tend to impose regulation when they are strong enough in respect for their customer to do so). In relation to this, Dalton et al. [2010] use a similar model as Griffin [2003b] with a "first-tier auditor" variable, to assess the market reaction for events in which regulations were not fulfilled (as in missing the 10-K filing deadline), suggesting that distinction over auditor tiers in relation to regulation adherence is justifiable, hence, client adherence to regulation may be a direct outcome of its auditor's independence.

Summarizing the evidence in research studies mentioned above:

1. Having an auditor with a considerable reputation may reflect as a safety net, as perceived in eyes of investors. However, this benefit does not come free of charge for firms, since they become subject to larger auditor scrutiny, which can be proved quite rigorous and persistent.

2. The percentage of on-time annual filings is significantly larger among first-tier audited clients. However, this correlation does not imply a causal connection, since there are studies which attribute the significant on-time filings amount to the credit of increased regulation adherence and better auditing expertise, originating from the auditor itself.

3. Changing environment: small auditors reported in the past for issuing quality audits despite their size [DeAngelo, 1981b] were found to be actually losing audit clients due to lesser reputation [Weiner, 2012].

2.2.3   Attributes of auditor's office/branch size and their effects

The share of first-tier audit market from all publicly owned US companies was indicated in GAO [2003] as an "intense concentration".

The dominance of the "Big 4" has been subject on forums as the Committee on capital market regulation on 2006 and the US chamber of commerce on 2006 and 2007, which dealt with the concentration of the latter at the audit market. The reason for these concerns was that the indicators at the market pointed clear ex-post results, as indicated by Francis et al. [2013]: "by 2006, the non-"Big 4" rate of restatements was over twice the "Big 4" rate, 10.58% versus 4.99%".

Taking the critical perspective, the research by Boone et al. [2010] which found first and mid-tier auditors to provide similar audit quality should be expanded to include a benchmark between first-tier and lower-tier auditors, in order to confront the data by Francis et al. [2013] that clearly shows different outcomes (double restatements rates) suggesting large differences in quality. Was the mentioned difference causal or simply correlative, and formed due to inherent client mix differences between the two auditor

groups? although modeling the "Big 4" was done in larger resolution (including office/branch sizes of auditors), no conclusive evidence for mentioned differences are found by Francis et al. [2013], settling for a general finding that the "Big 4" office size is (statistically significant) negatively correlated with restatements events, meaning the more a branch is large, the less restatements registered for its audited clients. An aspect of this phenomenon is well known and reflected by market investors, as the earning response coefficient shows significantly different values for "Big 4" and non-"Big 4" audits [Khan, 2006].

Several research studies [Ferguson et al., 2003; Vera-munoz et al., 2006; Francis et al., 2008; Francis et al., 2013] examine the similarities and differences between offices of the same auditor, while focusing on the first-tier audit group. Results presented by Francis et al. [2013] indicate that a top importance task among first-tier auditors is to achieve consistency across their offices, and that this task is perused by procedures, policies and methodologies each auditor develops and implements. [11]

Research advancement and recent changes: mentioned conclusions are relatively recent (post-2000), however, advancement in information technology related to knowledge distribution by auditors has been significant since Lu [2006], so it may be argued that a technology-based change is expected to occur and mitigate the said inter-office differences. Nevertheless, looking at more recent research [Francis et al., 2013] still doesn't reflect this advancement, and reach similar conclusions: "smaller offices of the "Big 4" accounting firms do not enforce the correct application of GAAP to the same extent as larger offices, resulting in more client restatements and implying lower quality audit outcomes by smaller "Big 4" offices".

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[11] Although the mentioned top importance of this task (and the large resources which are being allocated to it), studies [Ferguson et al. 2003, Francis et al. 2008] have found that success is limited, and that there are practical limits for the actual ability of an auditor to achieve adequate distribution of knowledge and expertise across all of its offices.

The mentioned inter-office audit quality difference may also be attributed to the clients themselves. As indicated by Reynolds and Francis [2000], large clients have more influence over auditors (than small clients), and prove to be treated more conservatively. It may be argued that clients of this sort are naturally concentrated at the geographical vicinity of large auditor offices, so that the office difference effect is actually an after-effect, and is just an outcome of an uneven geographical distribution of clients and not due to intrinsic differences between offices. This notion is supported by Francis et al. [2013], which studies the office size effect among mid-tier auditors and reveals the same effect is still present (while adding the indication it is not "Big 4" limited]).

An alternative explanation for this phenomenon is suggested by Craswell et al. [2002] which finds no office-specific effects at the Australian market, and suggest the office differences are significant at the US offices alone, as part of an organizational/market culture, and does not derive from accounting or operational origin.

Studies differences in respect for geographical homogeneity of mid-tier/first-tier auditors: while most research studies mentioned above (relating to "Big 4") is US based, other studies which are located outside the US, such as Azizkhani et al. [2010], Khurana and Raman [2004], focus on the Australian market as an alternative and present supportive evidence that there are no such differences between the first and mid-tier auditors. The Australian based studies relate this to the litigation and regulation differences between the two countries' markets and stock exchanges, and indicate the differences cannot be attributed to reputation issues alone. Furthermore, as concluded by Azizkhani et al. [2010]: "our results suggest that the insurance test does not explain differences in the value of "Big 4" audits", so the overall reference towards this subject is inconclusive and heterogeneous (showing mixed results).

Summarizing the evidence in research studies mentioned above:

1. Studies of the similarities and differences between offices of the same auditor suggest that there are practical limits for the ability of an auditor to achieve adequate distribution of knowledge and expertise across all of its offices, and as a result larger

offices of the first-tier accounting firms are better in the application of GAAP than smaller offices.

2. Although no conclusive evidence of major quality differences is found between first and mid-tier auditors, the difference between the first-tier and the rest (including small auditors) is significant, and is also reflected ex-post by the double rate of restatements among the non-first-tier auditors. Additionally, studies show that earning response coefficient holds different values for different auditor tiers. Similar results can be found in comparison among first-tier auditors themselves, in which the office size is (statistically significant) negatively correlated with restatements events.

2.2.4 Appraising the influence of auditor/client relationships

The relationship between auditors perceived attributes (as reputation and quality) and their clients' perception by the market has been a target for research during the past two decades [Francis and Wilson, 1988; Beatty, 1989; Simunic and Stein, 1996; Baber et al., 1997; Asthana et al., 2004; Weiner, 2012].

Discussion within these research papers is focused over the following questions:

- **Does client changing to an auditor with an increased (decreased) reputation cause an increase (decrease) in market reactions towards them (auditor's clients)?**

This question was addressed by Lu [2006], indicating that since auditor change is usually a step which is announced by firms, the share movements around the announcement day can be easily assessed and measured[12]. Research conclusions by both Nochols and Smith [1983], Schwartz and Soo [1996a] on the topic of auditor switch (in relation to reputation as an outcome of auditor's identity) state that auditor change does not affect the market

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[12] Lu [2006] uses more than 1600 events of auditor changes which took place at 2004 (on the US market) to indicate that only 61 events (4% of total cases) were concerned with firms which replaced auditors more than once.

reaction to clients. In opposite, results by Asthana et al. [2004] indicate such a connection may be established, although limiting the scope to voluntary changes: "for the voluntary changers, we find that the mean cumulative abnormal return during a three-day window surrounding the date of announcement of auditor change was positive and statistically significant"[13].

Taking the critical perspective, a distinction can be made to divide between pre-EDGAR and post-EDGAR research papers. It should be noted that studies which find no relation between audit change and market reaction are pre-EDGAR [Nochols and Smith, 1983], while the positive relation indicating studies are post-EDGAR [Asthana et al., 2004; Lu, 2006]. This does not suggest that the entire phenomenon may be attributed to a difference in the environment, but rather that the latter should be taken into consideration while examining events as audit switching, especially voluntary ones.

- **Does an increase (decrease) of auditor's reputation cause an increase (decrease) in market reactions towards the auditor's clients?**

Results are more homogeneous across the different research papers in this matter than in relation to auditor switching. Examining whether improved auditor reputation actually adds credibility to a client, research show supportive evidence in several cases [Francis and Wilson, 1988; Simunic and Stein, 1996] in which auditor's reputation is allocated by investors towards its customer. Research by Asthana et al. [2004] show results aligned with this notion (seen from the negative perspective) indicating that there is evidence that loss of auditor reputation is related with a decrease of its client's company values.

Asthana et al. [2004] makes an additional observation, distincting auditors which experienced loss of reputation and auditors with unharmed reputation. Following the Enron-Andersen case, Asthana et al. [2004] reaches the conclusion that the market actually

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[13] These results are aligned with another research conclusion regarding auditor resignation - as found by Shu [2000], in case of auditor switch which comes as an outcome on an auditor resignation, there is a statistically significant negative market reaction following the announcement.

reacts in a favorable way towards auditor changes which are away from Enron's auditor (Anderson). This notion is aligned with the indication that bad auditor reputation can damage firm values [Schwartz and Soo, 1996b; Boone et al., 2008], and disconnecting from such an auditor may result in a favorable market response.

As mentioned, one of the auditor's roles is serving as information mediator between investors and firms, and also as a confirmation authority to previously provided figures. Aligned with this perception, as indicated by Asthana et al. [2004], the auditors' reputation is impounded within the share price. Said price change (deriving from reputation) may be explained as a manifestation of the advantage (for investors) which resides in getting data from a qualified auditor, which is expected by investors to contain accurate information and a high-quality reporting. However, it may be argued that this firm-auditor-investor relation is not limited for a single direction - in case of a restatement, investors get a clear message that the original audit was problematic, and hence are destined to question the reliability of all information handed to them from the particular source (both auditor and firm). In this case, the implications move at the opposite direction, damaging both auditor reputation and client reputation (set aside potential damage deriving from the actual information content at the restatement). This phenomenon is studied by Francis et al. [2013], which concludes that "a client restatement is suggestive that the auditor did not enforce the correct application of GAAP… and there for the audit was of low quality"[14].

At this point, it is important to highlight a research by Boone et al. [2010], which studies the relationship of investors and auditors, and defines the following two measures: the first, actual audit quality, as proxied by earnings management. The second, perceived audit quality, as proxied by the equity risk premium [Boone et al., 2010]. These measures may be used to calibrate quality measurements for assessing both types of quality. Taking the

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[14] Supportive evidence for this findings is also mentioned at a panel on audit and effectiveness (Stamford, CT): Public Oversight Board relating to restatements as a "prima facie evidence of low quality audit".

critical perspective, the Boone et al. [2010] model may lack the strength to handle situations of counter-effects, upon which quality in absolute values stays fixed, but changes only with regard to other participants at the market. Put simply, in a highly concentrated industry, damaged <u>perceived</u> quality of several participants may lead to higher <u>perceived</u> quality of another, even if no <u>actual</u> intrinsic changes at the latter took place.

The connection between perceived audit quality (seen by investors) and the credibility of reported data (made by firms) is indicated in research by Dopuch and Simunic [1982]. This connection is also supported by Boone et al. [2008], stating that "investors' perceptions of audit quality play a critical role in maintaining systematic confidence in the integrity of financial reporting".

Investor-auditor relationship cause after-effects on additional factors, referred to by several researchers [Lambert et al., 2007; Kealey et al., 2007; Weiner, 2012]. These studies relate to the market response, whether performance related (cash flows) or formal (audit switch). As indicated by Lambert et al. [2007], one cannot relate to the quality of information residing at audit reports as reflecting an independent risk factor, since it covariances with the cash flows from the market (formed from investors' perceptions). Another important factor is related to the reflection of auditor-client relationship over investors. As indicated by Weiner [2012], the client choice of changing (or avoid changing) auditors is actually a signal for auditor's quality.

A research on involuntary auditor switch by Kealey et al. [2007] indicate that firms with longer tenure (with the specific client) actually get larger fees from their new auditors. Taking the critical perspective, this may bring up the possibility that change of auditors is actually bad for both audit firms (the old and new), since both experience a drop in fees. This statement should be viewed while considering a certain contradictory evidence suggested by Francis et al. [2013], that larger audit fees are related to more risky clients, which may have a mitigating effect for the fee change following the auditor change, hence suggesting riskier clients prone toward audit switch.

Summarizing the evidence in research studies mentioned above:

1. There is no uniformity among researchers as for the question of auditor switching effect over client's perception by the market. Several studies, (mostly pre-EDGAR) find no such connection, while recent studies (all post-EDGAR) succeed in establishing such connection, thus showing positive market reaction toward the switch.

2. Research over reputation changes of auditors and their effect over client's reputation reveal a correlation when measured against bad reputation: while bad auditor reputation may deter investors, good auditor reputation has less effect - when dealing with large firms, investors expect them to hire high reputation auditors as a default measure.

3. Auditors' reputation is impounded within the share price. This may be explained as a manifestation of the advantage (to investors) in getting data (via audited reports) from a qualified auditor, which is expected to contain accurate information and high-quality reporting and measurements.

2.2.5   Auditors motivation towards quality audits

Several researchers [DeAngelo, 1981a; Dye, 1993; Weiner, 2012] suggest the notion that auditors are incentivized in several aspects to issue better quality audits (some of which act as direct incentivizes, while others do so indirectly, as an after-effect). Auditors' motivation towards quality audits is referred to in research by two categories:

Category 1 – external deterring: the first category includes research studies dealing with negative reasons (relating to potential damage) that may be endured upon the auditor if bad audit report is traced back to him. Such studies examine whether large auditors which have "more to lose" are therefore being motivated to produce better audits in order to avoid consequences (auditors with good reputation may damage it, auditors with "deep pockets" may be vulnerable to lawsuits), and what are the measures taken by auditors about maintaining an adequate quality of audits.

Highlighted research studies of the first category relate to the following topics:

- **Reputation:** DeAngelo [1981a], Weiner [2012] indicate the simple equation in which an auditor which has more reputation may be damaged more severely by issuing a low-quality report, and therefore has more incentives in putting together an audit report in decent quality.

- **Finance:** as indicated by Dye [1993], auditors with larger financial wealth (referred to as "deep pockets") have an increased amount of risk when sued by investors. The conclusion in the latter research is that these auditors have incentives to perform a thorough and comprehensive investigation of clients, and issue a truthful and more qualified audit.

- **Litigation:** following the "deep pockets" notion mentioned above, a larger wealth of auditors may make them more vulnerable to lawsuits [Weiner, 2012]. Several papers indicate that big and wealthy auditors have more to lose in case of audit problems or failures, and hence are driven to pursue better quality audits [Feltham et al., 1991; Clarkson and Simunic, 1994]. Indication made by Choi et al. [2008] state that wealthy audit firms actually charge their clients with an extra premium fee, which is compensation for larger liability costs they infer, which in addition are driving them to issue better audits than smaller audit firms.

Category 2 – internal assistants: the second category in which auditor motivational research is conducted is tied with processes, collaboration and knowledge sharing. The latter is particularly applicable among first and mid-tier auditors, operating multiple offices, thus having a complex internal environment. Research studies within this category examine the creation of inter-office motivational systems, and investment (made by auditors) in developing operational advantages as knowledge sharing, collaboration and other practices taking place within large auditors[15].

Highlighted research studies of the second category are as follows:

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[15] These practices are examined as countermeasures for the risks mentioned at the first category group, because they contribute for better uniformity, homogeneity and consistency among audits produced across the organization (in different offices).

- **Operational:** operational advantages for size are indicated by McLennan and Park [2016], showing evidence that large auditors develop better technologies and processes, allowing them to teach and train their employees better, hence have more capable workers and issue better quality audits. This notion is somewhat limited in light of results demonstrated in research by Vera-munoz et al. [2006], which found "practical limits to knowledge-sharing practices that make it very difficult for large accounting firms to fully capture the expertise of office-based professions and to distribute that expertise uniformly across practice offices". [16]

- **Information content:** as found by both Beatty [1989], Davidson and Neu [1993], audits certified by big auditors are more reliable and credible (meaning, have better information content) than audits issued by their small counterparts. In addition, the mentioned studies conclude that having better abilities to access, formulate and display information enhance the quality of reports.

Dealing with reports quality, studies make the distinction between two types of quality. The first and the more immediate one is perceived quality, or quality as seen by investors. On the other hand, there is a more empiric version of quality, one that is measured in hindsight by events (as restatements) which imply that the original audit lacked quality.

An observation that should be highlighted is made by Weiner [2012], according to which some audits are more complex in nature (as an outcome of the firm, industry or both), and may require the auditor and the client to conduct complicated accounting procedures, that will enable to perform such an audit. Although audit complexity may be seen as an intrinsic attribute of the auditor (dealing with the perception of its complexity), it may also be

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[16] It may be argued that the described limits may dissolve as the technological improvements on knowledge collaboration and expert systems develop.

manifested as an external attribute, since it is dealing with a parameter originating at the audited firm itself. [17]

There is uniformity among in research [Palmrose, 1986; Feroz et al., 1991; Davidson and Neu, 1993; Francis and Krishnan, 1999; Francis and Schipper, 1999; Lennox, 1999; Weber and Willenborg, 2003] that larger audit firms produce audit reports with better quality. As indicated, the mentioned quality should be regarded in two separate levels:

- **Perceived quality**: as measured by investors' reactions.
- **Hindsight (ex-post) quality**: as proxied in events and attributes such as going concern notices, abnormal accruals, restatements and similar events taking place after an audit has been completed and published.

Hindsight quality, easily measurable and intrinsic in nature, offer several observations taken throughout the years in research papers: as indicated by Francis et al. [2013], larger offices' clients have less ex-post restatements. The uniformity of audits quality was indicated by Choi et al. [2007], Francis and Yu [2009], concluding that across the spectrum of different auditor office sizes, the small offices are likely to show lower audit quality in comparison with the large offices in a systematic and consistent fashion. This difference is attributed to the larger empowerment of a client having a larger office to manage the reported earnings. Similar intrinsic attributes are found by Francis and Yu [2009] documenting that going concern notices (as a representation of audit quality) are less likely to happen in small audit offices (holding all other variables constant).

Choi et al. [2008] indicate that the value of abnormal accruals is negatively associated with office size. A later research by Boone et al. [2010] expanded this observation by showing evidence of quality differences across "Big 4", mid-tier and smaller auditors (thus, differences exist not only among offices of the same auditor but also among auditor tiers).

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[17] It may be argued that the perceived quality of audit reports is not intrinsic, since it is an aggregated measure of investors' reactions toward a particular firm and its auditor.

Taking the critical perspective, is may be argued that large auditors invest more on inter-office knowledge sharing practices than mid-tier and small auditors, in order to narrow the differences in quality among offices, as a direct outcome of their size (larger firm naturally have more offices than smaller ones). If so, quality measurements should relate not only for auditor and office but also relate to the success of such practices in obtaining cross organization quality homogeneity. [18]

Intrinsic attributes: as indicated by Francis et al. [2013], the "Big 4" auditors employ a rather extensive battery of programs and practices, which distinct them from smaller auditors. These auditors employ training programs on a national level, standardization on audit programs, and also build and maintain practices for knowledge sharing which are firm-wide and information technology intensive.

These practices use as a significant tool in influencing the quality of audit reports: as indicated by Francis and Yu [2009], the larger "Big 4" offices provide better quality audit reports than the smaller offices do, a derivative of both larger in-house experience and competence among the SEC registrants. In order to minimize this difference (between offices), internal quality control reviews are conducted systematically by all the "Big 4" firms [Defond and Francis, 2005], using reviewers from different offices which travel between offices to conduct quality controls. Larger offices are argued by Francis et al. [2013] to have larger collective in-house experience with SEC related auditing, and therefore show more quality in auditing SEC registrants.

The external (non-intrinsic) roles of the "Big 4" auditors are examined in several verticals. Research by Khurana and Raman [2004] find that the insurance role of the auditor can sometimes outgrow the quality considerations of the audit. This is also supported by Boone et al. [2010], stating that "the "Big 4" auditor (have) financial resources and larger ability to share more of the investor's losses in the event of client failure", meaning "Big 4" audits

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[18] In accordance, a study by Francis and Yu [2009] showed that although using these practices, there is still large heterogeneity in office related quality, suggesting that this practices fail to achieve their goal in certain cases.

are used as a major influencer over investors (overlooking the quality intrinsic measure). Simply put, investors favor "Big 4" auditors for reasons not always related to the quality of their work.

Similar claims are made by Simunic and Stein [1996], stating that the investment which first-tier auditors made in building their brand names actually serves as insurance for investors, thus, it is ensuring the existence of an incentive to protect their (the auditors) reputation by providing credible and quality audits (hence, also overlooking the quality intrinsic measure and dealing with perceived quality).

Improved quality of "Big 4" audits may lay in their ability to restrain earnings manipulations. Two research papers [Becker et al., 1998; Francis and Schipper, 1999] indicated a similar view, in which, by being more effective in restraining audited firms from earnings manipulation, auditors are affecting positively the quality of audits. This conclusion is not aligned with evidence by Boone et al. [2010], which indicates that "the level of earnings management is similar for "Big 4" and mid-tier clients".

Taking the critical perspective, it may be argued that at the time (pre-2000), earning management frequency was somewhat larger among mid-tier auditors, hence the difference between the papers conclusions. This argument is aligned with Azizkhani et al. [2010] which concluded that there isn't a difference in quality between "Big 4" and mid-tier, based on the ex-post cost of capital, and states that "this consequence of diminished perceived audit quality persists at least until 2005".

To conclude – each segment of auditors (large, mid-tier and small) is attributed with reputation for bad quality audits, or lacking the ability/resources to reach high quality: it may be suggested that at start (pre-2000) it were the mid-tier auditors, which were marked to be more influenced to allow some degree of earning management [Francis and Schipper, 1999]. Later on, following numerous corporate scandals, the "Big 4" reputation was damaged and reached to the same point which the mid-tier were before [Boone et al. 2010], hence creating an equal state between them.

Another critical perspective may be attributed to the passing of the Sarbanes-Oxley act at 2002, which increased client and auditor incentives for making a quality audit, as noted in research by Boone et al. [2010]. This may also contribute to the final outcome reported of quality differences, simply by narrowing audit quality differences across auditor groups as an outcome of more rigorous regulation. Studying investor perceptions of auditors, Boone et al. [2010] concluded that investors see first and mid-tier auditors as actually providing audit services which are on the same quality. Measuring accruals perceived quality (by investors), Boone et al. [2010] shows that the difference in perceived value exists only among the entire auditors' population (including small auditors) and not just the "Big 4" versus the mid-tier.

Parenthetically, the distinction between "Big 4", mid-tier and the rest of the audit market may be argued as dependent on the ability of the first and mid-tier to invest heavily on training and knowledge sharing technology, which is capital intensive and produce outcomes whose magnitude are relative to size [Menike et al., 2013]. The size of the latter makes them less dependent on a single audited client, which in turn adds to larger independence auditors possess in the perception of investors. A comparison between first and mid-tier auditors should accordingly filter clients whose sheer size prevents them (or makes it quite inappropriate) from being audited by a mid-tier auditor (due to huge resources required for auditing). Such trimming is made by Boone et al. [2010], which excluded first-tier clients based on a simple rule measuring revenue: whenever the client's revenues exceeded the revenues of the largest mid-tier client registered that time, it was excluded from the dataset, thus obtaining a bias-free measurements (benchmarking only feasible auditors).

The mentioned "matching" between the first-tier auditors and their clients may also be attributed to increased auditor liability among the first-tier auditors. Boone et al. [2010] suggest setting a cap on first-tier auditor liability may eventually lower their dominance, and make the mid-tier auditors applicable to markets that are currently inaccessible to them

due to large insurance costs, meaning auditing high risk and profile entities as investment banks and institutional investors [GAO, 2008] [19].

The year 2008 financial crises (see section 12.1) had an outcome of enhanced public attention given to the American audit market, due to high publicity of negative events. From research perspective, it was followed by studies dealing with auditor switching within first-tier auditors caused by negative events [Chang et al., 2010; Weiner, 2012; Banimahd and Aliabadi, 2013]. Tackling the audit switching phenomenon, Weiner [2012] showed that a company which is not being audited by one of the first-tier auditors and is facing fraud, is likely to hire a larger auditor for future audits. However, this phenomenon is mitigated somewhat when measuring the market reaction towards auditor switching, which is done at the opposite direction - "Big 4" to mid-tier [Vera-Munoz et al., 2006]. As well, Banimahd and Aliabadi [2013], Chang et al. [2010] indicate that in the case of an auditor switch, the market is expected to react favorably (in a positive manner). Although this reaction is measured by Weiner [2012] on both fraud relating and non-fraud relating switchers, it may be argued that it contradicts the notion of the market as always responding positively to switching towards first-tier simply due to their better reputation, brand and enlarged liability.

Summarizing the evidence in research studies mentioned above:

1. Narrowing the scope to the first-tier auditors, they provide a higher quality of audits, implicatively due to larger in-house experience and expertise. The first-tier auditors also employ an extensive battery of programs and practices while investing in knowledge sharing and a supportive information technology structure.

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[19] This observation was made on GAO [2008], stating that: "investment bankers and institutional investors are motivated by insurance reasons to prefer "Big 4" auditors for their own clients and investees".

2. Looking at the advancement of research throughout the years, it may be argued that the first to mid-tier to the gap was larger at the pre-EDGAR period, in which the mid-tier auditors showed less success in preventing their clients from misconducts.

3. Firms are motivated by insurance reasons to prefer large auditors. In addition, being less dependent on a single audited client adds to perceived independence of mid-tier and large auditors (as seen by the companies and investors).

2.2.6 Summary

Summarizing the entire section of dominant features of the auditors' environment, the following outlines are made: auditors have several roles to keep, dealing with different parties in different means. They facilitate reports and audits, enforce truthful disclosures of information from firms by rigorous scrutiny of their operations. They also serve as a safety net for investors, which rely on their regulation adherence and their ability to restrain firms from misconducts. In addition, auditors have reciprocal relations with their clients. Both from quality and reputation aspects, shifts in perceptions for one party may cause a shift for the other as well, so the damage caused to auditor's reputation may incur reputation related damage upon its client's too. In accordance, switching auditors convey implications on both the client and its auditor. The mentioned reputation is impounded in the share price, due to the expectation (from these auditors) to produce high-quality reports with accurate information.

Mid-tier auditors share similar attributes of quality and accounting processes, which may be related to modern technological advancements, enabling knowledge sharing and cross-office collaboration. Smaller offices among the first-tier auditors show a larger percentage of restatements, which may suggest that there are practical limits for successful expertise and knowledge sharing across offices.

Auditors have the motivation to issue high-quality reports. The mentioned motivation is researched in several fashions (both direct and indirect), suggested to be shared by all auditors. Auditors deal with two types of quality – genuine and perceived, relating to the intrinsic quality of reports (and adherence to GAAP), and the perceived quality as seen by

investors. Large auditors have multiple offices, and invest heavily on processes and operational measures in order to ensure expertise and knowledge sharing throughout their branches. These measures are suggested to be helpful, since first-tier auditors are shown to provide a higher quality of audits, and their clients experience a significantly lesser rate of restatements (an ex-post sign of low-quality audit) in relation to mid-tier and small auditors.

A final note toward the auditor role and influence regarding earning announcements: Choi et al. [2007] show that there is a clear difference between auditors (and between different offices of the same auditor) when it comes to earning announcements timing and frequency. Research by Francis and Yu [2009] showed supportive evidence that earnings quality reporting is "systematically different" across auditor offices. In addition, it is demonstrated by Becker et al. [1998] that lower abnormal accruals are reported for first-tier clients rather than others. This may be a direct outcome of both auditor expertise and auditor independence, attributed for heterogenic client spread, in which large offices are assigned with different type and size[20] of clients, and therefore the abnormal accruals are just an outcome of client related attributes.

2.3 DOMINANT FACTORS OF REACTION TO ANNUAL FINANCIAL REPORTS

2.3.1 Preface: stock exchange regulative environment

U.S. Securities and Exchange Commission (SEC) regulations are comprised from several different acts: the securities act, the trust indenture act, the securities exchange act and the investment company act [SEC, 2002]. SEC is considered to be the primary securities

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[20] Pre-EDGAR research studies focus over similar size attribution to the investor reactions' side [Atiase, 1985; Bamber, 1987; Freeman, 1987] share the conclusion that investors react more strongly when earning announcements are made by small firms rather than by large firms.

regulator on the federal level [Dongwei, 2003]. Being an agency of the federal government, it holds primary responsibility for making sure the securities laws made by the federal administration are properly enforced, through proposing new rules and adjusting existing ones.

The relevant role of SEC from this paper point of view deals with research conducted over regulations of annual filings made by firms to the stock exchange which are not voluntary, meaning the Form 10-K.

SEC regulations determine publication filing as one being presented on a regular weekday (excluding Saturday, Sunday and holiday). After the filing has passed the acceptance review and the filing fee has been taken care of in full, the filing is then fed into the EDGAR information system, which makes it available for public domain after 24 hours from the filing event.

As reviewed in elaboration at the following section, there are quite a few research papers dealing with the topic of deadline acceleration and its impact on the market. Arguably, the reason that the acceleration act draws considerable academic attention may relate to tendency of researchers to aim their efforts in fields where abundant amounts of measurable data reside, according to the notion that the more elaborate the data, the more accurate predictions and conclusions can be extracted: accelerating the deadlines provide an easy benchmark for researchers, since it relates to the entire public firms' population. By splitting the firms into segments (by size, and deadline span as an after-effect), researchers can conduct comparisons in many verticals, such as investors' reactions, late or misfiling events and information content.

2.3.2   The impact of presentation timing on the equity market

A research recently published by Choudhary et al. [2014] examines early filings of annual reports, and provide supporting evidence that early filings are on average less informative when compared against filings made on time. Several reasons are proposed for the early reports lack of informativeness:

- Lower readability of the filings (longs sentences, complex, multi-syllable words).

- Less revision – since the correction and phrasing process is expedited.

- Preemption by previous voluntary information disclosure events.

The first two reasons can be referred to as operational in nature, thus flowing from technical reasons: early filing allow less time for revisions, text corrections and other editing measures due to the expedited process of auditing, phrasing and publication. Therefore, it is possible that the mentioned lack of informativeness only exists as an outcome of lower quality reports from a readability perspective, which is proved as harder to read by investors and hence lack informativeness. The research by Choudhary et al. [2014] should be highlighted because it aims the focus to another possible reason for less informative early filings, which is the presence of previous voluntary disclosures. As suggested at the latter, early filings are more likely (than on-time filings) to be preempted by other voluntary disclosures.

Failing deadline publication compliance is considered a serious event from a firm's perspective [Hirschey et al., 2003]. Although a small delay may be caused as an outcome of administrative issues (usually followed by issuing an NT filing, thus postponing the publication), the implications are often quite direct and immediate from the market [SEC, 2002].

Several studies dealing with filing reaction [Alford et al., 1993; Li and Ramesh, 2009; Choudhary et al., 2014] remove late filings events completely from the study scope (as a measure of bias prevention). As indicated by Balakrishnan et al. [2010], late quarterly filings are in fact perceived as signaling worse news than late annual filings. This may be attributed to the reason that since quarterly filings are easier to produce [Dye, 1993] (not audited, contain less information, less scrutinized), the fact a firm is late on publishing may suggest it is hiding information rather than just experiencing procedural or operational issue that can be fixed. This is consistent with conclusions made by Glass [2004], suggesting that late filings should be "accompanied by a heavy dose of skepticism",

meaning that attribution of late filing is not confined for operational and non-business related reasons.

Balakrishnan et al. [2010] claim that the effect of negative abnormal returns keep going even months after the late announcement. Therefore, the market reaction itself should be sufficient incentive for firms to avoid late filings, and that companies consider the market reaction when choosing to file late deliberately. For example, is case of avoiding public disclosures that will positively incur major share price damage (thus, containing information that will shift values negatively), managers may decide deliberately to endure the costs of late filing and postpone the mentioned disclosure as long as possible, hence, the outcome of continuous negative abnormal returns may be attributed to negative information residing in the publications, and not just for the publication's timing effect.

2.3.3 The impact of publication timeline changes on the equity market

A strong indication of the extent of the late filing phenomenon reside in Dalton et al. [2010] call for extreme measures required against late filers: "we find it curious that late filings seem to persist over our time period, and that the exchanges do not seem to enforce filing deadlines more vigorously". It may be argued that rigorous enforcement as suggested is not required, since the market response act as sufficient deterring and penalty mechanism (as indicated by Balakrishnan et al. [2010]).

Comparing at pre-EDGAR and post-EDGAR data: in contrary to other measures of information dissemination and investors reactions which changed with the implementation of EDGAR [Bryant-Kutcher et al., 2013], it seems that reaction for late filings stayed with no change [Glass, 2004], suggesting that the reason for reaction is intrinsic - improved accessibility of publications from investor's side, may not relate to (or have an impact) on late filing rate. This notion is further demonstrated in research by Choudhary et al. [2014] which relates to pre-EDGAR filings, and in research by Dalton et al. [2010] relating to filings from 2000 to 2008, with both studies revealing the same extent of negative market response to late filers.

Financial distress is primary reason for missing filing deadlines, as first indicated by Lawrence [1983]. Later findings by Alford et al. [1993] are aligned with this notion, indicating that 31% of late filers admitted that financial distress stood at the base of not achieving the deadline. In a critical perspective, it should be indicated that the majority of firms (69%) did not admit to experiencing such difficulties, therefore mentioned result can be treated ambiguously, since financial distress may not actually be the reason in most of the late filings.

Inspecting firm size for influence over late filings, Bryant-Kutcher et al. [2013] conclude that firm size is negatively correlated with late filing, and that the main determinants of not complying with deadlines are outcomes of firm size and complexity of audit required. In addition, Bryant-Kutcher et al. [2013] further suggest that firms having less internal control regulations encounter difficulties following the accelerated deadlines, due to the large gap between required audit standards and existing standards.

Determinants of internal control and material weaknesses as studied by Doyle et al. [2007] indicate that material weakness is likely to occur in smaller, younger and complex firms. Aligned with conclusions by Bryant-Kutcher et al. [2013], both conclude that the same measures causing material weakness in internal control are followed as an after effect with a tendency for failing to meet publication deadlines. [21]

Research papers dealing with the impact of early filing: the definition of early publication is somewhat vague, since it lacks a numeric precision, so several measurement techniques have been taken throughout research in order to formalize the correct time span for measurement (formulating the definition of "early"). For example, Choudhary et al. [2009] division of data suggest that the early definition should incorporate a 40% figure of reports, meaning "early" is relative and should be examined separately for each time period. This

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[21] Relating for stock exchange identity, Alford et al. [1993] showed that NASDAQ has more late filings than NYSE. This difference may be attributed for different firms mix among the two exchanges, or different industry mix (as the cause for change in measurements).

stands in opposite to a much smaller 14% figure that was suggested (measuring the same stock exchange) by Alford et al. [1993]. A probable explanation may be found at the definition of early, taken by Alford et al. [1993], that was treating a SEC Form 10-K as early only when it was delivered more than five days before the SEC deadline, hence setting a numeric definition for the "early" definition for number of days left for the presentation deadline, regardless of the actual presentation periods of other firms within a specific quarter (thus, using a fixed measurement rather than a relative one).

Early filings examined on two separate papers [Choudhary et al., 2009; Choudhary et al., 2014] show supportive evidence that there is less benefit to firms from early reports when relating to information asymmetry, and that the confirmation role of financial reports proves to be more relevant in case of early filings, as stated: "early audited reports can enhance this confirmation role if they are more reliable and allow firms to communicate credible reporting information via voluntary disclosures". Put simply, compared to on-time filings, early filings present less new information, and are often used for an ex-post confirmation of previously declared measures and information.

2.3.4   The impact of expanded regulation on publication

Focusing on timing issues of publications, several research papers [Hadi, 2005; Bryant-Kutcher et al., 2013; Choudhary et al., 2014] find shifting of various indices in relation for filings deadline change by SEC. It was SEC itself which defined the official goal of accelerations made to the publication deadlines as "improving the usefulness of periodic reports to investors" [SEC, 2002]. By stating so, SEC is actually treating old information as less useful, and impose larger deal of importance on data relevance rather on data elaboration (which requires time to formulate).

As indicated by Choudhary et al. [2014], the motivation for accelerating deadlines of reports is an outcome of the belief that publishing reports earlier will contribute to their informativeness. Looking into the effects of accelerated deadlines, Choudhary et al. [2014] state that "there are costs which accompany the benefits of shorter deadlines". Such costs

are usually related to quality attributes and measures of reports, and the ability of firms with such magnitude to issue readable and fully disclosed reports in a shorter time span. [22]

The mentioned measures focus on two main issues. First, firms are required to hold extensive control facilities, which in turn need to provide outputs and do the same amount of work at a considerably smaller amount of time (due to shortened deadlines). This may result in weaknesses complying with audit related resources, and force the organization to invest heavily on "filling the gap" of control/time ratio changes due to the accelerated filing. In addition, data gathering and processing measures need to be upgraded to support faster processing of information. Since the group of accelerated filing consist of very large corporations (exceeding a public float of $700 million), which are often multi-branched (and in cases global and operate in many different states), the need to gather information and perform aggregations in less time in order to present the correct data within the reports is demanding and requiring considerable effort and expertise.

As indicated by Bryant-Kutcher et al. [2013], acceleration of the publication deadlines did not cause any increase on late filers percentage, although concerns of that sort (stating that the shortened deadline present additional burdens which may not be faced successfully) are made by several parties, including accounting firms, law firms and academics [Weiner, 2012], and by SEC itself [SEC, 2002]. More concerns indicated by Hadi [2005] suggested that firms' managers will actually use the shortened deadline as an excuse for not making the SEC deadline, thus providing investors with a somewhat acceptable reason for late filing (in order to minimize the potential damage a late filing may impose).

Taking the critical perspective, it is worthwhile to note that one possible outcome of the shortened deadline is causing firms to invest more resources in their internal control mechanisms, in order to obtain the larger ability to provide financial information quickly and in a good quality. This may be a plausible explanation for results in studies as Bryant-

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[22] Additional studies [Hadi 2005; Bryant-Kutcher et al. 2013] indicate that shorter deadlines require rather extreme measures to be taken in order to comply, especially among the top group of large firms, required for a 60 days maximum presentation period.

Kutcher et al. [2013] suggesting that the acceleration did not increase the percentage of late filings (due to countermeasures taken), meaning firms haven't experienced an increase in late filings since they implemented internal measures which mitigated such events considerably.

Additional observation may be made between reactions for filings and reaction for litigation related announcements: litigation announcement and the reaction of the market (from price perspective) is researched by Griffin [2003b], Griffin et al. [2004], suggesting there is a negative response in the short-term price for the event of litigation announcement, which is followed by a long-term (few weeks) price response, also negative in nature.

The mentioned studies dealing with filings quality and usefulness may be categorized into the following groups:

1. **Filings usefulness**: studies showing investors share SEC's belief that timely information is more useful.
2. **Filings quality**: studies suggesting that despite required to comply with more extensive regulation, quality of filings is not damaged by the acceleration of deadlines. However, studies are ambiguous in regard for the reason for this to happen, and whether it should be attributed to counter-measures taken by firms (to avoid changes in quality) or simply to irrelevance of deadlines accelerations as a proxy for quality.
3. **Firms' size dependency**: studies dealing with the impact of accelerated filings deadline indicating it is not homogenous among firms, and depends on intrinsic firm variables such as firm size. Shortening the deadlines affected large filers (since it is applied by SEC using a public float based division), which is reported to invest more in internal controls measures, as well in fast data collection capabilities [Dongwei, 2003]. Firm size is negatively related to late filing [Choi et al., 2008]. When adding the fact that 31% of late filers admitted that financial distress stood at the base of not achieving the deadline [Balakrishnan et al., 2010], it may be argued that even larger percentage exists among smaller firms (since size negatively correlates with late filing).

Filing deadline failure: late quarterly filings are perceived as signaling worse news than late annual filings [Boone et al., 2010]. It may be argued that this is due to the reason that quarterly filings are easier to produce (being shorter and unaudited), and the fact a firm is late on publishing may suggest it is hiding information rather than just encountering procedural of operational misconduct that can be fixed. Early filings of annual reports are on average less informative when compared against filings made on time. In addition, early filings are more likely (than on-time filings) to be preempted by other voluntary disclosures, since they reduce the informativeness of the filings by revealing information before it is published via involuntary disclosures.

2.3.5 The impact of information contents on the equity market

Looking into different research studies dealing with information content and the usefulness of filings, it may be suggested that information content should not be treated as a standalone attribute, but rather should be assessed while referring to other attributes (such as price reaction). Apart from the straightforward role of filings (supply new information in an orderly fashion), some filings adhere to the confirmation role, thus allowing managers to perform an ex-post verification of prior published information (hence, making an ex-ante promise for voluntary information that will later be verified non-voluntary and ex-post).

Annual filings are regulated to include an elaborate narrative part, and therefore are naturally used for fundamental analysis. In fact, the effectiveness of fundamental analysis depends in information dissemination. Since both SEC and the market treat old information as less useful, it may be expected from new information to prove useful. However, it may be suggested that this is subject for additional parameters which affect investors[23]. One influencing attribute (from an investors point of view) is the complexity of filings. As elaborated at the text analytics theories section of the theoretical framework section, research shows that overly complex filings actually magnify the importance of second-

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[23] These attributes include investors and firm size, timing of filing, and a complexity measurement of firms, all of which has effect over the reaction toward information residing in filings.

hand effects, thus shifting investors to focus on secondary attributes of the filing (such as time, place, and auditor) rather than the actual text residing in the filings.

2.3.6   The impact of information/confirmation roles on the equity market

Studies dealing with information measurements make a distinction between two different roles of financial reports: information role and confirmation role. An observation that should be highlighted was made by Choudhary et al. [2014], according to which providing financial reports earlier enhance the information role of the reports simply by changing the costs related with private information search. It may be argued that this notion was more applicable at the pre-EDGAR era, as reflected from early research as Diamond [1985]. Information dissemination is better at the post-EDGAR era since private information search is computerized, hence more available and easy to obtain, so private information usage costs should be lower as an outcome (since large amounts of information are available seamlessly).

The confirmation role relates to financial filings as a way for managers to commit ex-post to truthfully shared information residing in non-mandatory filings. Furthermore, as indicated by Choudhary et al. [2014]: "if earlier audit reports are more reliable and accurate, they can more effectively confirm the information provided in voluntary disclosures". This suggests that early filing of annual reports do not contribute directly to the informativeness of the reports, and hence does not follow the information role – the actual role referred to in this case is the confirmation role, which is operating indirectly, simply by confirming data which was already published previously in other channels, voluntary in nature (and not mandatory as the annual filings are).

This ex-post verification is mentioned in both pre-EDGAR [Cready and Mynatt, 1991] and post-EDGAR [Ball and Shivakumar, 2008] studies. In addition, studies [Stice, 1991; Swaminathan, 1991] which are pre-EDGAR hold mixed conclusions as for the information content and usefulness of the annual filings. The same period showed no abnormal stock reaction to filings [Easton and Zmijewski, 1993], an observation which may suggest that

information content is not a standalone attribute, but should be observed while relating for price reactions for said information.

What is the extent of using information channels as a confirmation mechanism? Ball and Shivakumar [2008] indicated: "An alternative view to information role of reporting is that audited financial reports provide managers with a way to commit ex-ante to truthful voluntary disclosures because the accuracy of this information will be verified ex-post", meaning, using reports as a retrospective tool by managers, to communicate "word keeping" modus operandi to their investors[24].

Information relation to trading volume: an early research published by Beaver [1968] showed evidence that there is indeed an "abnormal trading volume" residing next to the financial reports' filing that infers information content. Trading volume was subject of additional papers [Bamber, 1987; Stice, 1991; Cready and Mynatt, 1991; Dontoh and Ronen, 1993], all confirming conclusions made by Beaver [1968] in regard to information effects on trading volume, and the abnormal trading volume detected after filings takes place.

Piotroski [2000] suggest that the effectiveness of a report filing in general, and the specific use of information in fundamental analysis depend on the ability of investors to successfully process its information quickly, and the exact manner in with information is flowing at the particular environment: "More importantly, the effectiveness of the

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[24] De Bondt and Thaler [1990] found that one can expect overreaction from analysts to "certain bits of information". However, it may be suggested that making a connection between overreactions of analysts detected at the early internet era [De Bondt and Thaler, 1990] and information asymmetry detected in a more technologically advanced environment [Choudhary et al., 2014] is problematic, since availability of data was smaller on the pre-EDGAR years.

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fundamental analysis strategy to differentiate value firms is greatest in slow information-dissemination environments." [Piotroski, 2000]. [25]

It should be noted that the SEC acceleration actually divided[26] the firms to three segments[27]. The downside of such acceleration may manifest itself in the quality of the reports, and at their accuracy, creating an opposite effect for investors (which treat low quality or less accurate data as less useful). Being positive or negative, it may be argued that the contribution of SEC's acceleration regulation needs to be measured in light of these two attributes – the benefits to investors in getting new information, in opposite to the downside of getting said information in a possible lesser quality or accuracy.

2.3.7   Distinction of technical and fundamental failures in report delivery

A specific research vertical focus particularly over the event of failing to meet SEC deadlines, the reasons for this to happen and the possible outcomes deriving from this event. As indicated by Hartlin [2008], the consequences of not following deadlines can prove quite significant from the firm's point of view. Such consequences are legal in nature, and can (in extreme cases) have the potential to revoke the firm's ability for trading, thus delisting it from the national stock exchange. Naturally, not complying with a regulated deadline is an event which should justly be expected to have negative outcomes.

Studies relate misfilings as an outcome of two separate conditions [Craswell et al., 2002; Ngoc, 2010]:

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[25] Parenthetically, the mentioned research act as a cornerstone for academic research dealing with information dissemination, and was cited by several researchers [Ball and Shivakumar, 2008; Li and Ramesh, 2009; Beyer et al., 2010] which also question the value of information conveyed by the SEC Form 10-K, suggesting possible connection between earlier filings and information asymmetry.

[26] Firms with under $75 Million of market cap were no included in the acceleration, firms with $75-$700 million market cap endured an acceleration from 90 to 75 days, and large firms (above $700 million in market cap) were accelerated to 60 days.

[27] The effective date was the end of 2003 for the middle segment, and the end of 2006 for the top segment.

The first, a "technical" misfiling, describes a filing which didn't meet the deadline due to logistic reasons, which can be internal, or auditor related. For example, if the auditor fails to produce and complete the auditing on time, or the firm relies on data that is proved false only in final stages of the process, it is considered as a logistic failure. It may be suggested that the most important characteristic of this type of misfiling is that it has nothing to do with the financial performance of the firm, and doesn't reflect any problematic situation that should alert investors as of the firms' future state. It is simply an outcome of logistic failure, and therefore should not impose any influence or affect over expected future returns (deriving directly from business operations).

The other type of misfiling represents the opposite situation, in which information about a future problem is delayed deliberately by the firm (i.e. its managers), in order to withhold negative information from the market as long as possible, even when taking into consideration the downside of a negative impact which is a common outcome [Bamber, 1987] of a misfiling event.

The inability to distinguish in advance between these events (only in hindsight) is one of the primary reasons to the negative market reaction for deadline holding failure [Griffin, 2003b]. Since the market participants cannot tell the difference in advance, hence, making the distinction between an operational problem which can be fixed easily (having no future implications) and a genuine problem which is kept deliberately hidden from investors. Therefore, the market chooses to treat the deadline misfiling as potential for presenting both situations, thus creating an always negative reaction for the misfiling. It is important mentioning that if, in hindsight, the deadline failure event proves to be of the first reason (a logistic issue that was fixed and has no permanent influence), the market quickly digest this fact and fixes itself upwards to the previous position [Lu, 2006].

SEC designated a special form, named NT 10-K, to be issued whenever a firm is unable to file the Form 10-K in time. The firm then receives an automatic extension of 15 days to complete the original filing [SEC, 2002]. A relevant observation regarding the NT form was made by Griffin [2003b]: "whether for substantive or perceived reasons, investors

typically view these filings as a negative signal". However, it should be noted that the NT filings can only result in a one-time grace period, and cannot be re-used for the same filing. While the grace period is set at five days for quarterly (Form 10-Q) filings, it allowed 15 days in case of a 10-K annual filing.

The impact of deadline acceleration on report delivery failures: SEC, as the legislative authority in charge of regulated disclosures made at the stock exchanges, enforce the decisions encapsulated at the filings deadlines act. As mentioned, this act serves both as a major incentive and a risk for firms traded at the US market, and for auditors. These deadlines are considered one of SEC's most prominent requirements [Griffin, 2003b]. Although the regulatory distinction between quarterly reports and yearly reports has existed for decades (due in 35 days and 90 days, correspondingly), the distinction based on market share has only been active since 2002, when SEC first shortened annual deadlines to 60 days for larger firms. The market capitalization threshold determined to distinguish accelerated fliers and non-accelerated fliers have been set on $75M.

2.3.8   Examination of restatements from auditors' perspective

Hirschey et al. [2003] indicate that overpayment of income taxes can be a probable outcome for misstating a financial statement. Erickson et al. [2004] indicate that from a $3.3B overstated earning that was made by firms, a figure of $320M was paid via taxes and that the average firm that overstated its earnings has paid 11% more taxes following the misstatement. Another reference for restatements considerable damage is given by Levitt [2000]: "In recent years, countless investors have suffered significant losses as market capitalizations have dropped by billions of dollars due to restatements of audited financial statements".

Restatements are a direct proof that initial reporting was done with low quality [Ball and Shivakumar, 2008]. This low quality is referring not just to the reports themselves, but also to the auditing attributes (scrutiny, data collection) which was done in relation to them. The mentioned relation is emphasized in research by Kinney et al. [2004], which add in

observation, that while there are several sources of which restatements can flow, most of them derive from two sources, the firm itself, or its auditor.

Data that flow from firms' managers is inspected by auditors with great extent and scrutiny, in order to prevent CEO's and CFO's to misstate (both deliberately and accidently). Regulations include severe penalties for misstating (even delisting in extreme cases), and pose requirements that narrow the chance for this to happen. In accordance, a research by Nelson [2006] indicates that SEC requirements and regulations show a positive contribution to diminishing managers originated misstatements.

Restatements serve as an admission that prior reporting was false, hence damaging the credibility of any future reporting from the same source - research conducted by Palmrose et al. [2004] found that the negative impact that restatements have over stock prices, when measuring at the two days following the restatements can mount up to 10%. As mentioned, research treats restatements in two groups, fraud originated and non-fraud originated. When comparing data from restating and non-restating firms, DeFond and Jiambalvo, [1991] examined different attributes of firms and documented evidence that restating firms that are smaller, less profitable or growing slowly.

As elaborated previously at the previous section, significant differences are attributed to the split between audits delivered by smaller offices rather than large offices (of the same auditor), indicating the correct application of GAAP is a matter of expertise which not all audit offices possess at the same amount [Francis et al., 2013]. A possible aspect of similar difference is supported in results documented by Kedia and Rajgopal [2007], indicating that "restatements are more likely to occur for companies locating farther away from SEC regional offices". This evidence suggests that geographical proximity to the regulator is affecting the compliance with regulations, although regulation is imposed evenly (on a federal level) with no relation to physical dispersity.

Segmenting by audit-tiers provide another distinction: as showed by Defond and Francis [2005], going concern notice opinions are negatively correlated with the geographical distance from SEC regional offices only among non-first-tier auditors, while it is none

existing among first-tier auditors (investing heavily on knowledge sharing and inter-office collaboration). To summarize, both restatements [Kedia and Rajgopal, 2007] and going concern notice opinions [Defond and Francis, 2005] are more common when firms are located far from SEC offices. Looking into long-term under-reaction to restatements events, a research by Hirschey et al. [2003] indicated a significant increase in the amount of firms which are restating their financial statements (in percentage figures, as a portion of the overall active and traded firms at the specific market) during the four years between 1995 and 1999. Evidence by Hirschey et al. [2003] indicate the number of such firms (restating their filings) was four times bigger than in the equivalent previous period, hence, suggesting a periodic mechanism which operates cyclically in different magnitudes. [28]

The primary motive leading for restatements is defined in research by Dechow et al. [2003] as the desire of the management to achieve lower costs for external financing. Auditors, as gatekeepers in charge of preventing misstatements, act as "reputational intermediaries" [Li and Ramesh, 2009], over which the investors count with verifying their decisions[29]. Seeing the managers as the sole blame for restatements was one of the leading forces towards the SOX reform, as Kinney et al. [2004] indicates: "the perception that restatements are largely attributable to management abuses and the ineptitude or complicity of auditors led to the passage of the Sarbanes-Oxley Act of 2002". It may be argued that this notion sets the cause for required regulation not only at the doorstep of firm's managers, but at the auditors themselves, which are attributed to either incompetence (ineptitude) or deliberate tampering (complicity).

Several studies [Dechow et al., 1996; Turner et al., 2001; Richardson et al., 2002] discover a significant reduction in returns when looking into restating firms' performance. Figures move from -6% [Dechow et al., 1996] to -12% [Turner et al. 2001]. An influence of -11% is found by Richardson et al. [2002] in studying population of "255 companies either

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[28] Similar supportive evidence are also presented in research done by Kinney et al. [2004].

[29] This situation is referred to as the failure point of the statements process by Coffee [2003].

revising earnings announcements or announcing restatements of financials from 1977 to 2000". Measures indicating the influence of -10% were pointed out in GAO [2002] over a five's year data from 1997 to 2002.

2.4 GLOBAL RESEARCH

This section reviews studies conducted in various stock exchanges throughout the world. The drawn conclusions are set in order to form matches and correlations in between researchers, based on their geographic spread. As demonstrated, there are several characteristics which pose a significant influence on international research. A clear hegemony of US-based research may be seen throughout the literature available on stock exchange related research. Although research on stock exchanges on other parts of the world is quite sparse in extent terms (when compared against the US-based research), it is nevertheless diversified and elaborative in certain cases, and covers several aspects of the stock exchange environment.

2.4.1   Select research studies conducted over non-US exchanges

A study by Menike et al. [2013] find abnormal returns surrounding the release date of annual reports. This study was conducted at the Colombo Stock Exchange. The same as the latter, Naser [2002] also find abnormal returns around the release date of annual financial reports. This study is conducted at the Stock Exchange of Saudi Arabia.

A study by Ngoc [2010] show that investors make decisions while relying on accounting information as a primary source of reference. This study is conducted at the Vietnamese Stock Exchange.

A study by Karimi and Sadeghzadeh [2010] find that share price fluctuations are affected by factors other than information disclosure. This study is conducted at the Tehran Stock Exchange, Iran. Although larger 10 times than the Karachi Stock Exchange ($170B market

cap[30]), the Tehran Stock Exchange enjoys an advantage of holding state-owned firms which were privatized under the Iranian constitution.

A study by Hayati [2010] show that financial reports and announcements are a primary indicator for future investors' response to the referred firm (meaning, investors reactions depend on past reports when making future related decisions). This study was conducted at the Indonesian Stock Exchange. Also conducted at the same exchange, Opong [1996] find that investors respond significantly to signals of information residing in annual financial reports.

The Sri Lanka stock market reactions to the release of annual financial statements, which are the parallel of US SEC Form 10-K, are researched by Menike et al., 2013. The research at the Sri Lanka Colombo Stock Exchange examined whether there are abnormal returns or volume changes which can be attributed to annual statements, as the ones detected at the US market. It proved correct, which means the same event was observed in both stock exchanges, as stated: "abnormal return and cumulative abnormal return around the release of annual financial statements are positive" [Menike et al., 2013].

All Studies mentioned pay attention towards returns as a primary indicator of market response. In accordance, it is visible that studies succeed in providing supportive evidence for correlation between accounting information (in general, and financial reports annual publications in specific) to the market response as measured by the investors' reactions. Therefore, it may be argued that response patterns for information in financial reports follow similar trends in stock exchanges throughout the world, and are not confined particularly to the US market, despite its unique data dissemination supporting environment (EDGAR).

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[30] Data retrieved from www.sijoitus.org/world_stock_exchanges - SVnet - World Stock Exchanges

2.4.2 Research bias deriving from data access and availability

It may be suggested that research studies dealing with filings are subject for bias in two major aspects: the first aspect, geographic in nature - research is biased towards US exchanges due to significantly cheaper data collection (elaborated in this section) related costs, and easier accessibility measures [Khan, 2006].

Khan [2006] benchmarked stock exchanges based on their informativeness (proxied in costs of data gathering process), and indicate that the New York Stock Exchange was on top of its counterparts in terms of data availability and sharing. The research indicated that "the New York stock exchange was found to be the most 'user-friendly' and informative secondary source of information". In addition Khan [2006] indicate that major stock exchanges in Europe allow data access through a single online channel (more limited than EDGAR). It may be suggested that features mentioned lead to a rather centered and biased research data selection, which shifts toward putting an unnatural emphasis on the US market (due to the seamless collaboration of data, user-friendly interface, and cost of data) [31].

Although the mentioned data related bias the conclusions of International studies and US-based studies do not differ significantly, suggesting different geographies share the same global attributes (with reservation to major exchanges examined). Though the magnitude of reactions vary and is subject for immediate environmental issues (government, economic development), the phenomena and their respective direction are the same throughout major exchanges in different continents.

A large portion of the research conducted over the relation between investors and accounting information is US based. Apart from the immediate reasons (the US is a world-

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[31] With almost $20T market cap, the NYSE is much larger than other leading exchanges such as NASDAQ ($6.8T), the London exchange ($6.1T), the Tokyo exchange ($4.4T), the Shanghai exchange ($3.9T), or the Frankfurt exchange ($1.9T). The two biggest exchanges in the world are NYSE and NASDAQ, with a combined market cap of $25T. All figures above based on 2015 public data. Retrieved from World Federation of Exchanges, 31 January 2015 Monthly reports.

class center for both business and academic research), this fact may also be attributed to the EDGAR system, which is very accessible and therefore act as a primary information source for researchers.

To conclude, while research papers mentioned throughout this literature review tend to focus on the US-based stock exchanges, (which are SEC regulated and operated by EDGAR automation environment), several papers establish theories and offer new understandings based on differences which are geographical in nature, that means, they offer a new perspective by trying to impose roles, facts, observations and conclusions that were achieved over one location (such as the US-based stock exchanges), and test them in front of other stock exchanges and market environments throughout the world.

The intensity of research available in English which is US based (whether in the data source or in target market) may relate to the fact that the United States has the largest English speaking population[32]. However, it may be suggested that this derives from the reason EDGAR (the market automated system which is used at the US market) is free to use and naturally contains the most information (a direct outcome of the US market size).

For comparison, Canada has created a parallel system that performs the same functioning roles as its US counterpart, named SEDAR. The SEDAR system which was established in Canada is not free, and required a fee of approximately $800 for initial use (as of 2015). Charging for usage is naturally an obstacle in free access to research data, and may just be the reason additional papers (including those of Canadian origin) choose to use the free data available on the EDGAR system.[33] Parenthetically, since some research papers dealing with natural language processing are using corpuses of several thousand of documents

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[32] Retrieved from American Community Survey by the U.S. Census Bureau, 2007

[33] Another example of a market which holds a fee policy for accessing its data is the London stock exchange. The fee for accessing data for the UK market requires a 10 pounds fee (as of August 2015) for accessing a firm's annual report via its web site.

(including this paper), using a "pay per file" policy may prove to be capital intensive, this may well serve as a contributing factor to the concentration of research at the US market.

3. CHAPTER III: HYPOTHESES FORMULATION

3.1 AUDIT-TIER EFFECTS HYPOTHESES

Epitomizing audit-tier characteristics research, the following arguments are made:

Auditors carry an important role as mediators between public firms and market investors [Francis and Yu, 2009]. They also facilitate market transactions through sharing their professional opinions over financial statements and reports made by firms [Titman and Trueman, 1986]. By doing so, they have a profound impact on all of the market's participants [Dye, 1993].

Audit-tiers, and the uniqueness of the first-tier are elaborated in this literature review, showing several key differences between audit-tiers:

1. Firms audited by a first-tier auditor are more likely to adhere to regulations [Dalton et al., 2010]. They are also more likely to provide timely filings [Schwartz and Soo, 1996b], and are more reliable and credible as seen by investors [Beatty, 1989; Davidson and Neu, 1993].

2. Auditor size is positively correlated with auditor independence [Watts and Zimmerman, 1983], and with extensive scrutiny and restraint of customers [Weiner, 2012].

3. Large auditors reflect as a safety net for investors [Banimahd and Aliabadi, 2013].

4. First-tier auditors have better quality audits, as reflected in lower restatement rates [Francis et al., 2013].

5. First-tier auditors with more reputation are incentivized to conduct better quality audits [DeAngelo, 1981a; Weiner, 2012]. In addition, a larger financial wealth of first-tier auditors, leading to increased amount of risk and lawsuits vulnerability also act as incentivizers for quality audits [Dye, 1993; Weiner, 2012].

6. First-tier auditors have operational advantages supported by their size [McLennan and Park, 2016].

Summarizing, auditors have an important role in the market, and they differ significantly when segmented into audit-tiers. Said differences suggest that the first audit tier is incentivized toward better audits, more successful in restraining clients for regulations and timekeeping, has larger independence and employ more scrutiny over its clients. In addition, first-tier auditors have the financial resources required to facilitate a significant capacity of operations in order to conduct an adequate audit, both from technical aspects and from reputation/business related aspects.

In accordance, it may be hypothesized that the differences between audit-tiers are not confined for scrutiny of clients, but are also reflected in written audit reports.

Therefore, larger scrutiny and better audit quality among the first-tier auditors should reflect via the extent of produced reporting, which is thrall, intensive and contain elaborate discussion over all aspects of the audit.

Such reports (audited by first-tier auditor) are expected to be longer and include complex words and longer sentences, used to achieve accurate, precise description of the topics discussed. In addition, numeric figures will be accompanied by narrative analysis (side notes or comments), meant to interpret their exact nature and implications.

Accordingly, the following hypothesis is formulated:

H1: Form 10-K reports audited by a first-tier ("Big 4") auditor are more complex (have a larger narrative ratio and are longer) and hard to read than reports audited by a non-first-tier auditor.

3.2 ANNUAL TRENDS HYPOTHESES

The data used in this study is retrieved from the NASDAQ stock exchange, for the decade spanning between years 2005-2015. US Nominal GDP (in billions of Dollars) grew from

$13,093 in 2005 to $48,856 in 2015, US GDP per Capita grew from $17,348 in 2005 to $50,902 in 2015[34].

Therefore, it may be argued that since the US economy, and US firms presents a consistent, growing trend, this trend will also materialize for audit firms, which in turn not only grow bigger, but audit larger clients, thus requiring larger operational capabilities.

An additional changing aspect is information technology, which is presenting a consistent trend and improved abilities in general, and is also suggested to show advancement specifically at the financial arena, as in knowledge distribution by auditors [Lu, 2006], developing better technologies and processes [McLennan and Park, 2016], and producing information quickly, in large volumes [Bryant-Kutcher et al., 2013].

Following the two trends mentioned (market growth and technological advancement), it may be argued that if the audit market (as a whole) is expanding, and the tools (both technological and operational) are constantly being developed, these trends will manifest themselves in the composition and characteristics of financial audits in general, and in Form 10-K reports in specific - with larger resources at their disposal, larger capacity and capabilities and larger clients to audit, audit firms are expected to present a higher quality of audits with time. **Such reports (produced with larger capacity and capabilities) are expected to continuously grow longer, and include complex words and longer sentences, used to achieve accurate, precise description on the topics discussed, and accompany numeric figures with narrative analysis.**

It should be noted that this growth is hypothesized to occur at the entire population of auditors (regardless of their respective tier), since the growth in resources and technological capabilities, and the growth of the market itself is not limited or exclusively confined to a specific segment.

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[34] Retrieved from Bureau of Economic Analysis, Official United States GDP data online repository at www.bea.gov

Therefore, the following hypothesis is formulated:

H2: Form 10-K reports present a consistent multi-year trend in which reports are growing more complex (have a larger narrative ratio and are longer) and hard to read.

3.3 PERFORMANCE EFFECT HYPOTHESES

It is indicated by several researchers [Francis and Wilson, 1988; Beatty, 1989; Simunic and Stein, 1996; Vera-Munoz et al., 2006], that the stock market responds to events and attributes related to auditors, and that auditor reputation and client reputation have a reciprocal relationship - the identity of the auditor has an effect on investors, and auditors' reputation is impounded within the share price [Asthana et al., 2004]. This may be explained as a manifestation of the advantage (for investors) in getting data (via audited reports) from a qualified auditor, which is expected to contain accurate information and high-quality reporting and measurements.

Another influencing factor over investors is concurrency of publications. Concurrency of periodic reports and information is causing significant reaction changes, as indicated in models of both Kothari [2001] and Li et al. [2009]. Since information digestion capabilities are finite, even institutional investors (let alone non-institutional, small-scale investors) may not be able to cope with high concurrency of publications made close to the SEC deadlines.

In addition, investors are affected by dates of publication. Li et al. [2009] points out that 26% of files are submitted five days surrounding the quarter end date. Several studies [Musto, 1999; Carhart et al., 2002; Morey and O'Neal, 2006; Li et al., 2009] indicate significant market reaction around calendar quarter-end dates. In accordance, it may be hypothesized that investors react to two separate types attributes when digesting information:

The first, intrinsic attributes (see elaborated definition at the Terms section), which depend only on the Form 10-K report itself, and doesn't relate to external events. The intrinsic

attributes are parameters calculated from the text of the report, and act as Meta-data on top of the content, describing complexity and readability of the text for readers. Such attributes are deriving from the narrative characteristics of the report.

The second type of attributes are external attributes, which are not intrinsic but rather exist within a particular context, deriving from different parties as regulatory authorities, other firms and auditors (for example, publication load concurrency and peak publication proximity). These attributes derive from circumstantial/peripheral events (such as concurrency of publications made by other firms), or from deliberate firm managers decisions made regarding the auditing firm or the specific publication date (and its proximity to the regulated deadline).

Being so, the intrinsic and external attributes may express themselves differently: the intrinsic attributes require more time and resources to assess, since they reside inside a long and complex narrative text. The external attributes are more immediate, since they require less effort to estimate (for example, information regarding the auditor's identity, or making sure a specific firm is coping with the regulated deadline and not being late).

On the short-term, investors are hypothesized to react specifically to the publication event, while the content of the report comes to significance only at the long-term. Such outcomes may come to realization in both performance and its volatility, so the hypotheses relate to them both.

Therefore, the following two hypotheses are formulated:

H3: Short-term stock performance and its volatility are affected by <u>external</u> attributes of Form 10-K report publications.

H4: Long-term stock performance and its volatility are affected by <u>intrinsic</u>, content related attributes (readability, complexity) of Form 10-K report publications.

Hypotheses H3 and H4 require formulating an additional, supplementary hypothesis. Even if external attributes are supported as short-term influencers, and intrinsic attributes are

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supported as long-term influencers, how do each of them operate within the opposite term? For example, external attributes (hypothesized in H3 to affect the short-term) may have a lasting effect, observed also in the long-term.

In order to relate to the influence of external and intrinsic attributes in both terms (short and long), the following is additionally hypothesized, arguing that there is a different type of reaction expressed in the long-term and in the short-term, hence, there isn't a group of attributes which comes to significance in both terms (short and long).

Therefore, the following hypothesis is formulated:

H5: Investors' reaction to Form 10-K reports is expressed differently in the short-term and in the long-term.

3.4 VOLUME EFFECT HYPOTHESES

The final hypothesis in this study relates to trade volume (see Terms chapter for an elaborated term definition).

As indicated by Loughran et al. [2009], readability and complexity of Form 10-K reports have a specific effect on small, non-institutional investors, in which less complex reports will materialize in larger trading volume registered from small investors. A similar indication [Miller and Gregory, 2002] notes that readability improvements as the "Plain English Act" (see Terms chapter for elaboration) follow the same pattern of influence. Following the measurements of abnormal trading volume surrounding the filing of periodic financial reports [Dontoh and Ronen, 1993;You and Zhang, 2009], it may be argued that a certain portion of volume changes is attributed to investors reaction, which is influenced directly from readability and complexity attributes of information.

As mentioned, this study use a similar framework to the one used by You and Zhang [2009], in which measuring volume volatility is achieved by comparing coefficient of variation of the volume movements within the year prior to the publication, in order to

achieve a benchmark for assessing volume volatility for a specific time frame and firm, based on historical figures.

It may by hypothesized that if lesser trading volume for small investors is an outcome of low readability [Loughran et al. 2009] or high complexity [Miller and Gregory, 2002], its effect on large, institutional investors may be significantly lesser, but not completely the opposite – meaning, if smaller investors react negatively to such reports, large investors are not likely to react positively, but rather in a similar negative manner (even if mitigated significantly). Therefore, the effect on the overall population of investors (without investors size related segmentation) should present similar negative reaction for low readability and high complexity information.

Therefore, the following hypothesis is formulated:

H6: Complex and less readable Form 10-K report publications have a negative effect on trade volume volatility.

4. CHAPTER IV: THEORETICAL FRAMEWORK

This chapter reviews theories built and used in previous studies, which deal with the same disciplines as this study. Accordingly, emphasis is given to theories dealing with quantitative data produced from free-text. Due to the previously mentioned inter-disciplinary nature of this study, theories are addressed in two main verticals, which are the measurement of text (information), and the measurement of returns (investor reaction impact).

In writing this theoretical framework, particular emphasis is given to the following topics:

- **Theories development and advancement:** reviewing changes in concepts and methodologies occurring throughout years.
- **Selection of sources:** gathering theories from several disciplines to allow a multidisciplinary overview of methods.
- **Recent development and relevance of studies:** reviewing recent and up-to-date techniques which are implemented in studies conducted in the recent years.
- **Group theories by similar views:** in order to allow comparison not just among different papers but among different concepts, studies are bundled by their respective use of theories and disciplines.
- **Highlight points of disagreement:** in accordance with the previous item, studies are confronted to emphasize differences in both methods implemented and outcomes.
- **Critical evaluation and perspective:** adding sections of critical evaluations for different sections (relating to different theories) is conducted in order to highlight issues of disagreement or problematic aspects concerning the mentioned theories.

4.1 MEASUREMENT OF FINANCIAL REPORTS TEXT CONTENTS

4.1.1   Readability indices

This study uses three techniques for measuring text readability (see Terms chapter for additional elaboration on these indices creation methodology):

- Gunning FOG index
- Automated readability index
- Flesch-Kincaid index

These indices act as a measure of readability, calculated over writings in the English language. Readability gauging is based on a principle of assessing the amount of education required to understand a certain text after reading it for the first time. For instance, a document with a FOG measure of 12 requires an education at the level of high school senior (US) in order to comprehend in a first-read.

All three techniques have some inherent limitations, among which the assumption that complex words are difficult to comprehend. This notion may prove problematic especially when dealing with technical papers which consist of jargon words, which although being long are rather simple for a reader with professional background of the specific topic [Doyle and Magilke, 2012].

This study utilizes readability indices to get a quantitative measure of the readability differences between various reports. The three methods represent different measuring techniques, and apply different measurements for text readability – while FOG is considering complexity by a concrete boundary (above three syllables), ARI is using characters count to measure word complexity, and Flesch-Kincaid is using the relative syllable count. Using all three readability measurement techniques enables an assessment of readability even when texts are abundant in jargon words. There are several cases demonstrated in this study (see section 6.4) in which statistical significance differs between the three readability measurement techniques.

4.1.2   Financial text analytics

Interpreting financial text sources contribute not just for hindsight analysis of reader's reactions to the text's content, but also for providing predictive capabilities. Whether official/regulated (as narrative audits) or informal (as news and analysts reviews), textual sources may be digested and used in various methods: this chapter reviews analysis techniques, which when implemented over financial related texts offer models for simple and single dimensional measures (as word count, syllable count), documents benchmarking (by comparing relations of text between the document and its corresponding corpus) and formula based text readability (as the FOG, ARI and Flesch-Kincaid indices).

The impact of the Plain English act over financial texts readability is examined in empirical studies [Gifford et al., 2009; Loughran et al., 2009] based on measuring the acts impact on publications. Findings by Loughran et al. [2009] show that Form 10-K text informativeness and readability improved after the Plain English Act was in place. These results are aligned with observations made by Gifford et al. [2009], in which readability scores following the act are smaller, hence publication are easier to read. Since SEC emphasized the benefits of the Plain English act are directed at the least sophisticated investors (SEC release #34-38164, p. 24), which are reported as more influenced by readability of annual reports [Miller and Gregory, 2002; Loughran et al., 2009], a synergetic relation of two concepts appears: from one hand, less sophisticated investors are getting access to information that is suited for them and easier to understand (due to improved readability). From the other hand, these investors are the ones affected most by the readability of information in financial reports (as an outcome of private information gathering costs, lack of inside channels and alternative sources), so it may be deducted that the Plain English act caused a significant change for small investors[35].

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[35] The conclusions from both studies [Miller and Gregory, 2002; Loughran et al., 2009] suggest that theories based on text complexity should include models that consider several target populations, since they may contain different mix of reactions (hence, reaction measurement should be done separately for each target audience).

Based on text complexity, the "first generation" of text analytics theories concentrated on creating complexity indices for assessing both single documents and entire corpuses [De Bondt and Thaler, 1990; Dontoh and Ronen, 1993]. Such plain measure of readability is adopted by You and Zhang [2009], using models based on word count (the number of words in a document).

Containing hundreds of pages, financial reports may be rather complex (even when not containing elaborated accounting practices) due to their sheer size. Since investors (as a recipient for these reports) need to process the residing information properly in order to make educated, information-based decisions, and react respectively, their ability to comprehend information have a direct impact on such reactions. The average annual financial report for SEC contains about 42 thousand words [Li et al., 2006], so the extraction of information in a systematic way and benchmarking thousands of transmissions made each year demands a significant amount of computational resources [Asthana and Balsam, 2001]. Considering that models by [Kothari, 2001; Ball and Shivakumar, 2008] define variables with larger granularity (as syllable count and words diversity) in order to check complexity within a corpus, the information digesting resources required may prove quite substantial.

Taking the critical perspective, as indicated in research by Loughran et al. [2009], theories using methods as syllable measurement produce biased figures. This is due to the fact that business texts use long complex words to describe common practices, like the phrases "corporation", "executive" and "directors", which although containing many syllables are natural and easy for comprehension by most investors. An example is set by Loughran et al. [2009], which is referring to the word "telecommunications" as a sample for the inaccuracy of relating for syllables as a proxy for complexity, indicating a multi-syllable word of a common phrase, therefore, theories using this model may suffer from an inherent bias. Loughran et al. [2009] state that the top quartile of multi-syllable words is likely to be known to the average reader of Form 10-Ks.

Using theories based on measures of readability, studies [Miller and Gregory, 2002; Li, 2008] formulate different types of connections between the content of words in financial reports and different outcomes as measured in the market, referring to stock returns in particular, indicating that annual reports which were more difficult to read yielded smaller scale results (performance-wise), so that better written reports are more informative. Such findings are also corroborated by Li [2006] and You and Zhang [2009].

4.1.3   Theories based on advanced text analytics

Predictive analytics models of financial texts focus on the relationship between written content and the prediction abilities of future returns, from both volume and performance aspects [Miller and Gregory, 2002]. These models may include variables describing fluid nuances such as optimistic/pessimistic notions, sentiment analysis and complex text structures.

Advancements on hardware and software frameworks enable researchers to develop theories which require processing datasets in larger scales [Bryant-Kutcher et al., 2013]. Due to financial reports text intensive nature, it may be suggested that narrative accounting and the research of its usefulness for all parties involved (auditors, investors, and firms) hold large potential: a distinct trend in which emphasis is given to the narrative attributes of financial texts in general, and annual reports in specific is one of the indicators for the growing popularity of text related research articles published within the accounting discipline [Asthana and Balsam, 2001; Griffin, 2003a; You and Zhang 2009].

A study by Li et al. [2006] points a way toward future theories which will allow more systematic analysis of public texts such as periodic filings, announcements, statements and restatements, and more "soft" sources such as news and analysts reviews. Researchers employing text analytics are already reaching conclusions in areas hard reaching by conventional research -for example, a study by Loughran et al. [2009] indicate that "there is a clear positive relation between the improvement in a firm's plain English measure and

increases in the proportion of 100-shares trades' volume"[36]. Such research is involved with text analysis of large amounts of text, and deriving aggregate results from the latter. As indicated by Li et al. [2006], the information residing in numbers and figures is still getting more attention from investors than information in texts (such as narrative accounting reports) which is being overlooked or ignored (relatively to the non-narrative information). When dealing specifically with annual reports text, these results suggest that there is a significant under-reaction to the textual information, in comparison with the reaction to the reaction for the numeric data.

A theory that should be highlighted is developed by Loughran et al. [2008], suggest a model which tests the use of terms with an ethical relation over the SEC 10-K annual reports. Using a corpus of 12 years, the findings provide supportive evidence that Form 10-K which tend to use ethics related words and phrasings more frequently are more likely to get a lower score when measuring their respective firm's corporate governance. In addition, these firms proved more likely to be subject to lawsuits. These observations establish a reliable link between vocabulary used in Form 10-K reports and indirect events relating for business related topics.

Research conducted by Loughran et al. [2008] use theoretical model tested against a corpus that was built during the years 1994-2006. The first part of the sampled data is published during the years 1994-2002, defined at the research as the "pre-regulatory" period. The second part of the sampled data is published during the years 2002-2006, which accordingly are treated as the "post-regulatory" years. This method allowed the proposed model to control for regulation adherence, in specific with the ethics regulation mentioned.

Taking the critical perspective, the early period (pre-regulatory) is characterized by an infrequent voluntary usage of ethics related words and phrasings at the Form 10-K [Callen et al., 2006], while high usage of such words came after the regulation (the regulation itself

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[36] Blocks of 100 shares are the standard trade size on U.S. stock exchanges (retrieved from Zacks Investment Research, available finance.zacks.com/trade-stocks-blocks-100-shares-8384.html).

drives firms to conduct a conversation on their ethics position and morals as a part of the fillings). Therefore, it may be argued that the theory that was structured in research done by Loughran et al. [2008] had to use data just from the pre-regulation period, when data was voluntary, since the non-voluntary use of specific words may lead to inherent bias relating of choice of words.[37]

Text related regulation: the Sarbanes-Oxley Act (commonly referred to as SOX) which passed on July 30, 2002 contained section 406 named "Code of Ethics for Senior Financial Officers", directs the SEC to "issue rules requiring public companies to disclose in their annual report whether they have implemented a code of ethics for their senior financial officers"[38]. SOX directed SEC to require all the firms to address the subject of ethics at their filings, thus changed the predictive capabilities favorably merely due to the fact that these using ethics related words (as in Callen et al. [2006]) were not voluntarily anymore, but an outcome of regulation directives.

Influence of wording and language used to characterize a trend is demonstrated in a model developed by Morris et al. [2005]: "holding information about stock price trends constant, investors' expectations of trend continuation are influenced by the language used to describe the trend". Similarly, research by Shiller and Pound [1989] indicate that affecting stock returns is not an immediate outcome of negative words, and that in order to show a significant change in returns, novel information should be present within the overall information delivered. Taking the critical perspective, it may be argued that this is the reason for the conclusions presented by Francis et al. [2002a], which indicate that an ongoing trend is present in which information about earnings and balance sheet information is provided in increasingly growing details (thus, meant to supply novel information). A

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[37] This serves as an example of how regulation can actually lower the information role capabilities of the financial reports: "Post regulation, when most firms are required to discuss their codes of ethics in the annual report, the vast majority of 10-Ks include an ethics-related term, as would be expected, thus diluting any information content in its usage" [Loughran et al., 2008].

[38] Retrieved from Securities and Exchange Commission publications, 17 CFR Parts 228, 229 and 249, Release Nos. 33-8177; 34-47235; File No. S7-40-02, Rin 3235-Ai66. Available at https://www.sec.gov/rules/final/33-8177.htm.

later study by D'Souza et al. [2008] present a model corroborating this and show the same trend and outcomes, hence supporting the notion that information quantity (in granularity/resolution aspects) point to usefulness.

4.1.4 Text enrichment techniques (news, announcements)

External (non-official/regulated) text impact over the stock market is a sub-category of financial text analysis related research. A model built by You and Zhang [2009] document price changes of stocks in relation to news publications, while making a distinction between "good" and "bad" news. As indicated, bad news cause a downward drift in price, and good news cause the opposite. Magnitudes of drift are measured at 2-10%, in a single quarter timespan [You and Zhang 2009].

Relating to annual filings, Li et al. [2009] analyze the news surrounding delayed annual filings, and indicate that they cannot by distinguished from the non-event periods. A similar conclusion is presented by Choudhary et al. [2014] which examines the news surrounding the opposite type of filings (early rather than delayed) and indicate as well that there is no significant evidence to suggest early filings experience lesser response simply due to lack of news coverage.

A geographically based observation is made in research by Frost [1997], focused over the same methodology as Hirshleifer and Teoh [2003] (which found there is a larger focus at the market in times where information which is relating to a big number of firms is being introduces in the same time) but uses data from the UK stock exchange rather from the US-based exchanges as Hirshleifer and Teoh [2003]. The research suggests that similar findings (larger focus) are also observed at the UK stock market, however, while adding a new attribute – the UK research relate to a new parameter, according to which larger reaction is given from the investor's side to positive tone disclosure. The reason for this difference may be caused as an outcome of difference in composition and diversity (mix) of investors between the US and the UK markets, and the ratio difference of institutional/noninstitutional investors between US and UK exchanges.

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A study by Cordell et al. [2006] examine the usage of both pessimistic and optimistic language phrasings at the press releases of earnings and suggest a theory to eliminate the influence of earning surprise and other elements which may shift the response of the market, thus isolating the influence of using specific words and phrases known to be optimistic or pessimistic in nature. Using a corpus of 24 thousand earnings announcements between the years 1998 and 2003, the model by Cordell et al. [2006] show success in providing supportive evidence that optimistic language usage shows a positive correlation to firm performance, and pessimistic language shows a negative correlation with the performance measured.

The following researchers offer theories measuring the effect of language over communication. The first, Hoskin et al. [1986], showed that the combination of modeling numerical and textual disclosures (which reside at the announcements with the accompanied text), proves to yield larger prediction abilities. Similar evidence was later indicated by Francis et al. [2002b]. The third researcher, Katz [2001], relate to the rhetorical choices an organization makes in both diction and style.

Summarizing the evidence in research studies mentioned above:

1. Improved abilities of text analytics led to gaining popularity of text analytics in financial research, which is text intensive. As an outcome, focus is put on theories which address narrative accounting, and provide a benchmark evaluating text influence, communication and responses. Expectations of researchers mentioned are that theories in this field of research will gain more popularity over the next years due to technological advancements, although results mentioned show that information in numbers and figures is still getting more attention from investors than textual information.
2. Text analytics capabilities are influenced by environmental attributes, so models should be fitted to support external variables.
3. Several theories use the immediate online availability of financial news for enriching data and perform better in forecasting market behaviors. While researchers agree upon

the effect good and bad news have over the market, they still limit the magnitude of such effect for small influence (although beneficial for forecasting).

4. SEC directed "Plain English" act to assist the least sophisticated investors. Procedures were taken seriously by participants (firms) which complied with the regulation in a satisfactory fashion (from SEC point of view). Plain English was synergetic and proved helpful for less sophisticated investors. Not only are they able to get information in a way suitable for them (simple/plain), they proved to be the population that was more affected by information in financial reports in general (even before the Plain English rule).

5. Theories dealing with filings complexity as a predictor for market response show success prediction abilities in several studies, when limiting the scope for small, unsophisticated investors. In addition, complex filings prove hard to interpret by the small investors and therefore cause a consistent behavioral shift, correlating positively with complexity.

6. Several studies mentioned indicate the inaccurate and biased figures obtained by models using single dimensioned text analytics methods over filing texts. This is mentioned as the primary weakness of theories using a single dimensioned criteria (simple count measures) in order to create an elaborate benchmark in between the corpus documents.

4.2 EQUITY MARKET REACTION MEASUREMENTS THEORIES

Events from various types (early or late filings of financial reports, restatements and press releases) cause investor to react [D'souza et al. 2008, Easton and Zmijewski 1993, Fairfield and Whisenant 2001]. These reactions are benchmarked for estimating magnitudes and significances of correlation between information and its respective reaction [Fields and Lys 2001]. Several types of theories are elaborated in this section – the studies reviewed are conducted in different verticals, referring the internal composition of investors, different investor types, and homogeneity of investors.

4.2.1 Reaction measurement theories based on timing factors

Research by Dontoh and Ronen [1993] relate to the issue of detecting abnormal trading volume surrounding the filing of periodic financial reports. Testing the filings both from timing and from the originators (filing firms) point of view, results suggest a lack of homogeneity among investors, in which different types of investors tend to act in a different patterns, thus, reactions for the same type of events is not the same for investors from different types. This may reinforce the notion that changes in filings presentation timeline[39] not only possess an influence on investors, but may also cause a shift at the investor mix interacting at the market in relation to a specific firm, hence creating an secondary effect (reactions change also due to the reactors themselves changing). This suggests that a change in reports publication time not just changes investors' reactions, but changes the investors mix in turn. Therefore, the early presentation may possess an indirect influence over the stock performance not due to its intrinsic properties, but rather through the different types of investors reacting to its data, meaning that the prices are affected by the reaction of different investors to the delivery of reports. Put simply, it may be suggested

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[39] filings presentation timeline may derive either from regulation changes, forcing firms to issue audit reports at designated times (as the acceleration act) or from a firm decision to conduct an early filing of reports, hence deliver the filings to the stock exchange before the due deadline.

that abnormal reactions which are measured for filings are an outcome of different types of trading investors (not just different reactions of the same investors).

The presence of said secondary/eco effect aligns with previous results by Meier and Schaumburg [2004], in which benchmark is done over a single type of investors – institutional investors, in order to examine the effect of a change in publication dates (focusing in specific on institutional investors). The conclusion presented indicate that this specific group of investors may possess incentives to trade in specific dates, which makes them unique from other types of investors. The model used present supportive evidence that institutional investors as a group may favor trading near quarter-end dates, so there is an end of quarter bias in favor of a specific investors group (institutional investors). As for the reasons this happens, the research indicate that there isn't any apparent reason which leads to this behavior: "the end of quarter trading activity is not easily accounted for by momentum/relative strength strategies and is not associated with strategies that on average provide any added value to investors, even before accounting for expenses. Nor can liquidity costs explain these findings".[40]

To conclude, theories utilizing a filtering mechanism, in which models are implemented over a single segment (be it by investor type, date selection etc.) show the ability to successfully detect existence (or lack of) abnormal reactions, both from volume and performance aspects. The mentioned filtering allows to eliminate bias factors [Gifford et al., 2009], hence performing better in modeling market reactions. However, since in certain studies mentioned the scope was limited to a specific segment (type of investors), it may be argued that these theories lack generalization abilities and present results which are also segment specific.

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[40] Since the research was limited to US equity mutual funds it may be argued that is does not qualify to outline the behavior of institutional investors as a whole, but rather portraits a view of a specific segment.

4.2.2 Reaction measurement theories based on behavioristic attributes

Over-volatility of the stock market is documented since the pre-EDGAR era, by Shiller and Pound [1989]. Looking specifically into stock market crashes, the study find evidence that investors are reacting to one another in addition to the news from the market, and that this additional reaction serves as the primary reason of the high magnitude of events[41]. Shiller and Pound [1989] propose a model in which relating for such event is done through filtering reactions to primal (initial) reaction only – this is achieved by filtering the eco-effect of investors reacting to other investors (using a timeline filtering), and focusing on immediate reactions (which are suggested to be direct from the news event). Research by French and Roll [1986] support this methodology, showing that the volatility of prices at the US stock market is larger at times when the market is open for trade than in times when the market is closed, and attributed these gaps to eco-effect among investors.

Another aspect of investors' reaction may be seen at the phenomenon referred to as the post-earnings announcement drift, or the "PEAD" effect[42] (named also the "SUE" effect). First observed by Ball and Brown [1968], the PEAD effect is attributed to the failure of the investors to fully encapsulate or digest the new information which is given during the earning announcement. Instead of assimilating quickly (as the efficient market theory suggests it should [Fama, 1970]), there is a significant abnormal returns pattern of the shift, measuring for at least 60 days following the announcement. This topic is addressed in later research by Hirshleifer and Teoh [2003] which test whether individual investors can be marked as a cause for this phenomenon (as oppose to institutional investors). The results

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[41] It was suggested Kahneman and Tversky [1973] that intuitive forecasts made by investors proved that the latter tend to give lesser weight to data which is less salient, and on the opposite give over emphasis on salient information.

[42] "PEAD" is a short for "Post Earnings Announcement Drift", also known as SUE effect, it represents a phenomenon in which a change in abnormal returns is moving (drifting) at the same direction of the earning surprise event, for considerable time span (weeks and months) after the mentioned event. The most common explanation for this to happen is an auto-correction for an under reaction of investors to earnings announcements.

are distinctively negative: "we find no evidence that either individuals or any sub-category of individuals in our sample cause PEAD. Individuals are significant net buyers after both negative and positive earnings surprise" [Hirshleifer and Teoh 2003]. However, the research indicate that the reactions of individual investors change in relation to load volume of reports they are facing. The findings that post-earning reactions are smaller in scale when the day of the announcement is relatively busy (from announcements perspective), meaning many announcements made that day. Taking the critical perspective, it may be argued that models which rely on measuring reactions should address the text digesting capabilities of each group of investors (individually), since small investors possess lesser capabilities than institutional ones (due to costs of information gathering/digesting), hence reaction measurement theory should adjust reactions not only by segmenting by events, but also by the ability of recipients (investors) to digest information regarding the mentioned events. Put simply, since individual investors have less information gathering resources, their information handling capabilities are limited in scale, which may be a factor which leads toward an under-reaction for concurrent events (since information does not reach assimilate as fast as it does among institutional investors), and may serve as an explanation for ongoing trends existence.

4.2.3   Measurement theories based on reaction for external events

Research conducted by De Bondt and Thaler [1990] propose a model focused over a specific population, the securities analysts. The research examine tendency of securities analysts for producing extreme forecasting figures, and conclude that securities analysts act in similar to investors from a behavioristic point of view, and share the same over-reactions to salient data. According to De Bondt and Thaler [1990], the tendency of investors to over-react for salient data is in fact encouraged furthermore by security analysts, which are influenced by the same type of data, and effecting investors (through their recommendations) even more. Put simply, securities analysts prone to overreaction, and investors (already over-reacting on salient data) are in addition influenced by analysts as an eco-effect. A similar shift is demonstrated by Callen et al. [2006], indicating that more informational components reside in annual filings for firms with short-term investors,

meaning that firms whose investors may be described as sophisticated and long-term will tend to find less information (which is value relevant) at the filings, and annual filings are argued to be more useful for short-term investors, and for unsophisticated investors as well.

Taking the critical perspective, it may be argued that the mentioned bias of securities analysts is an outcome of a sample selection issue, made over a specific time span. When considering the measurement of investors' underreaction by Abarbanell and Bernard [1992] in relation for earning events, no suggestion is indicated why two types of events should present such differences in outcome (under-reaction for earnings versus over reaction for salient information)[43].

Research by Fairfield and Whisenant [2001] focus on a particular type of event, which is the sell recommendations made by analysts. This study suggests that while expanding the scope for the following year after the recommendation has been made, a statistically significant negative impact may be found on stock performance. Fairfield and Whisenant [2001] attribute this to the force encapsulated in fundamental analysis with capturing and identifying aggressive accounting measures by firms trying to hide their real position, and the long lasting impact such measures hold among investors. Since fundamental analysis examines (among else) a multi-year set of reports, and measures the reliability of information disclosures, indicators as for the lack of the latter may have a long-term negative impact. A study by Li et al. [2009] find that the market reaction to Form 10-K reports is limited to cases in which the filings contain brand new earning related information, however, modeling this may prove quite difficult to implement since classifying "new information" should consider the specific population exposed to the information, hence "new" is relative for each investor, and should not be treated as new only once presented.

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[43] Although the research by Abarbanell and Bernard [1992] is limited to earning events, it has succeeded in obtaining a significant results indicating that the analysts are under-reacting to certain types of information.

Looking into parameters other than price is also present in different models: You and Zhang [2009] establish a relation between return volatility and volume increase after filing times. These parameters may be used for in quantifying qualitative attributes, as Li [2006] which measured risk sentiment as a proxy for reactions to filings.

It should be noted that using unexpected figures as a target variable as Callen et al. [2006] is not limited to performance, but can rather be implemented on trade volume. Such measurement are taken by You and Zhang [2009], suggesting a framework in which filings are measured in light of the unusual trading volumes observed during filing. Measuring the unexpected portion of volume activity is accordingly done by comparing coefficients of variation of the volume movements within the year prior to the publication, in order to achieve a benchmark for assessing volume volatility and the impact which publication has over it. As elaborated in the methodology chapter, a similar technique is implemented by this study as well.

Measurement of market reaction may be confined to a certain time frame. For example, a methodology implemented by Doyle and Magilke [2012] relate to the market reaction within three days after the SEC annual filing. In the mentioned model, firms are additionally segmented in different verticals, based on time, size and industry[44]. This type of aggregated day reaction measurement is also implemented in this study, extending Doyle and Magilke [2012] by using two time frames of 3 and 21 days post-publication. The justification for designated timeframes is also found in similar time-frames (few days versus few weeks) made in previous research [Asthana and Balsam, 2001; Meier and Schaumburg, 2004] obtaining significant statistical evidence.

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[44] Research by Dalton et al. [2010] regarding SEC deadline acceleration also use industry segmentation and indicate some industries show better deadline compliance. The latter study showed that there are three major predicates for late filing. These is discussed in elaboration at the literature review and are mentioned here as an example for the importance of external attributes measurement. Results show the following attributes are marked to indicate lower levels of proning to late filings: firms trading at NYSE, firms which were considered "on the radar" from major analysts and firms which are audited by one of the "Big 4" accounting firms – all mentioned prone less for late filing.

4.2.4   Highlights of investor's reaction measurement principles

Summarizing the evidence in research studies mentioned, the following observations are made:

1. In order to describe multi-dimension relationships, theories should relate to data with sufficient granularity. Several theories mentioned hereby [Abarbanell and Bernard 1992; Asthana and Balsam, 2001] limit the scope for a certain perspective (relating for selected segments or measures alone). For example, there are models relating to timespan, to geographical dispersity, to certain events (as earnings announcement, late/early filing). Models mentioned [Carhart et al. 2002] suggest that certain types of events are known to be related to overreactions or under-reactions from market participants. Since these reactions are also proved [Cordell et al. 2006] to create a drifting reaction state (for example, in salient information reaction, or in overreactions of analysts), including a timeline dimension may assist to account for long-term corrections.

2. Several events mentioned produce both direct and indirect influences, and cause second-hand influences (referred to as eco-effects), in which parties are affected by other affected parties. For example, securities analysts are prone to overreaction in certain cases [De Bondt and Thaler 1990], and investors respond not just directly for the information in those cases but also to the overreaction by the analysts [Kothari 2001]. This describes a circular mechanism, in which reactions are causing additional reactions (ripples). In order to cope with the mentioned events, measurements are taken in separate over the first-degree impact, and the respective part of the second-degree ones (counter reactions/eco-effects).

3. Information access and information digesting capabilities are predictors for reaction, measuring the extent in which information may be acquired, absorbed and assimilated by the different parties. The extent of information acquisition and absorption is a direct factor for the eventual magnitude of reaction. In order to cope with the populations that differ in one of the mentioned dimensions (i.e. information digesting, data assimilation

capabilities), each attribute upon which the populations differ should be controlled separately.

4. Increased price reaction is tied with incentives of institutional investors for "window dressing" [Hirshleifer and Teoh 2003][45]. Such actions are documented [Kim and Kross, 2000; Landsman and Maydew, 2002] in relation to institutional investors. Models measuring reactions may filter specific end of quarter abnormal figures in order to mitigate this phenomenon.

5. Behavioristic approach theories relate for situations in which investors are reacting to one another in addition to the news from the market. This inter-investor reaction may be regarded as a contributing factor of extra-elevating the magnitude of events already high in magnitude. Mitigation for the phenomenon is available through time-frame limitation, taking into account only changes made within a short time-span, thus not measuring ripple and eco-effects.

6. Filings presentation not only have an influence on investors, but also makes the shift at the investor mix which interact in relation to a specific firm [Meier and Schaumburg, 2004]. A particular group of investors may possess incentives to trade in specific dates, which makes them unique from other types of investors. Techniques for measuring information show [Miller and Gregory 2002, Morris et al. 2005] that firms whose investors are sophisticated and long-term will tend to find less new information (which is value relevant) at the filings. Since filings are aimed at the average investor (Plain English initiative can be seen as a reinforcement for this notion), they (average investors) are likely to find the filings more useful. Therefore, theories dealing with measurement of informativeness account for investor types attributes. Investors mix differ from one firm to another, thus, measuring the impact of filings for all the firms based in the aggregate investors response may turn out to be non-accurate [Shiller and

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[45] The term "Window dressings" describes a situation in which in order to improve the appearance of the portfolio performance before presenting, the manager will sell stocks with large losses and purchase attractive stocks near the end of the quarter.

Pound 1989], significantly shrinking the magnitude of elements impact due to the averaging taken (from investors perspective).

7. The first model to establish a "statistically reliable link" between excess stock return around the filing date is proposed by Griffin [2003b]. Recent models [Doyle and Magilke, 2012; Bryant-Kutcher et al. 2013] suggest that the filing/price proxy relationship is mainly correlative (and not causal), and in fact is limited to co-occurring events which create investors reaction.

4.3 EQUITY MARKET REACTIONS: EXTERNAL INFLUENCERS

4.3.1 Heightened investor response measurements in specific events

The following studies examine heightened investor's response on filing events (both quarterly and annual). Responses are segmented by the following attributes:

- **Investor size:** as indicated by both Loughran et al. [2009], Miller and Gregory [2002], the complexity of annual filings affect small investors in a greater extent than large ones, which have larger competence in dealing with complex filings (requiring extensive accounting knowledge and information digestion capacity).

- **Firm size:** as indicated by Griffin [2003b], more attention is given by investors toward annual filings made by smaller firms than to filings made by larger firms.

- **The timing of publication:** as indicated by both Griffin [2003b], Li et al. [2009], investor responsiveness is larger in days with a large number of publications. In addition, filings made after the due date are related with negative responses. It should be noted that the latter reactions may be restricted to price changes and less to volume, for example, as indicated by Li et al. [2009], reactions for calendar quarter ends cannot be statistically distinguished for with and without filing event. Griffin [2003b] also indicate that response from investors around publication dates is increasing consistently, but limited to a window of one to two days following the publication.

Concurrency theories use data deriving from more than one event (taking place at a designated time span) in order to model reciprocal relations between events and detect mutual influences. These theories concentrate over two verticals: the first - press release and news concurrency, and the second - periodic filings concurrency. For example, at first vertical, as indicated in results by Li et al. [2009], when firms report lower earnings in annual filings in comparison to earnings releases, they are likely to issue a press release which highlights the downward change. At the second vertical, concurrency of periodic reports and earning information prove to produce significant price and volume reactions in models by both Kothari [2001], Li et al. [2009]. An observation by Li et al. [2009] show that after excluding the mentioned concurrency, the market reaction around the annual filings is restricted to reports with quarter end proximity.

An additional type of concurrency deals with earnings announcements made in conjunction with Form 10-K filings: Firms may use earning announcements as a preempting event, in order to change information layout for a subsequent event, such as Form 10-K [Choudhary et al. 2014]. In this case, the earnings announcement effect is not depending on the announcement alone, but is also correlated with the time span of the publication from the regulated deadline. Choudhary et al. [2014] examine whether the information of the announcement is different (in relative to the aggregate information - announcement plus report) when dealing with early filings. The finding provides evidence that there is a significant trend, in which early filings with preliminary announcements actually have a larger ratio of information (when measured against on-time filings). The research concluded as follows: "early Form 10-Ks are less likely to have a subsequent earnings restatement and are less likely to be amended".

Market response is intensified by publications even when the information in filings is actually previously published, as indicated by Griffin [2003b] "filings register a market response … even though some information at the filings such as an earnings announcement may already be in the public domain". Taking the critical perspective, this may be an outcome of two scenarios. The first, not all investors are exposed all the data. Since data amounts are abundant, and investors' capabilities are restricted, it may be argued that

investors will not be exposed to the same data from two channels (the announcement and the financial filing combined) but actually be exposed for only one of the two. In addition, even of the latter does happen and investors are exposed to two publication bearing the same information, it may act as a confirmation role entity, and strengthen their confidence in the information given, so the after effect will be increased volume of reaction from their behalf. This phenomenon is supported when viewing technological advancements related to information flow between firms and investors - as indicated by Bryant-Kutcher et al. [2013], technological advancements enable firms to produce earnings information quickly and in large volumes, however, these announcements does not replace the scrutiny needed to prepare the annual filings.

It is possible that multiple information dissemination channels also reflect in the news (due to a large extent of coverage), hence causing a larger reaction among investors. A model by Choudhary et al. [2014] use announcement data and news as input, and suggest that early filers which issue earnings announcements have more proportion in news over both announcement and filing events.

Research by Li and Ramesh [2009] indicate they "significant market reaction surrounding quarterly periodic reports only when their filing coincides with the first public disclosure of earnings", suggesting that unless releasing novel information for the first time, market reaction (that can be attributed directly to the mentioned information) is expected to be small. Observations made by Li et al. [2009] regarding the reaction for Form 10-K files state that there is a positive association between the market reaction of non-filings firms and filings made by other firms, suggesting that there is a connection in which firms filings are affecting non-filings firms performance as well. Dealing with events concurrency and market reaction around calendar quarter-end dates, several studies [Musto, 1999; Carhart et al., 2002; Morey and O'Neal, 2006; Li et al., 2009] indicate significant market reaction around calendar quarter-end dates, thus corroborating the relationship between timing and reactions.

Studying the relation of market reaction to filings of Form 10-K, Li et al. [2009] indicate that the volume of trading around the calendar end dates is mixed for both filers and non-filers, and therefore a distinction cannot be made between the two (in order to create significant difference in a particular group). In addition, Li et al. [2009] point out that due to deadlines by SEC, 26% of files are submitted five days surrounding the quarter end date. This group differs from the overall average profile of a filing firm: "Large firms, firms with high institutional ownership, and firms with a high book to market are less likely to file their 10-ks on calendar quarter-ends", Li et al. [2009]. Similar results are indicated by Carhart et al. [2002], showing "significant price reactions" at the calendar quarter ends. However, Carhart et al. [2002] does not find any significant changes in volume at the mentioned dates, but rather indicate the significance resides only in price changes.

To conclude, in order to model reciprocal relations between events and detect mutual influences, the mentioned theories use data deriving from more than one event, taking place at a designated time span. While relating for different attributes of the mentioned data (time, complexity, population and recency), correlations and causality between certain pairs of event-reaction can be detected and proved statistically significant.

4.3.2   Reports usefulness ambiguity in relation with reaction

A certain amount of ambiguity can be found in studies regarding annual filings done under SEC. For example, You and Zhang [2009] indicate that investors view annual filings as formalities which don't hold any valuable information and therefore largely ignore them as a whole. On the opposite, studies as [Griffin 2003b] state that these filings are "undoubtedly the most comprehensive and details single source of financial information available to market investors". The usefulness of annual reports also receives contradicting indications: a favorable approach by Griffin [2003b], determines that Form 10-K annual reports are actually anticipated by investors, and use as an important source of information for them. On the other hand, Ball and Shivakumar [2008] state a somewhat milder position, indicating that annual reports do provide information, but when compared to other sources of information they are actually less informative.

Ball and Shivakumar [2008] use the mandatory attribute of publications, and propose a framework relating to the voluntary/mandatory origin of data as significant attributes when measuring informativeness. When run against market data, the said model suggest that disclosures which are not mandatory yield better informativeness to investors. As indicated by Loughran et al. [2009], documents written in better quality are actually more informative for investors. This notion is aligned with the previously mentioned results found by You and Zhang [2009] regarding a stronger under-reaction of investors dealing with more complex annual filings. When taken into consideration with the findings made by You and Zhang [2009] that investors actually "underreact to information contained in 10-K", the immediate question which arises is whether or not the annual filings are too complex as a whole for certain types of investors with low information digestion capacities, and therefore magnify the importance of voluntary information. The notion suggested is that some complex annual filings, cause in turn that certain investors react primarily based on factors accompanying the filings instead of the filings information.

4.3.3   Reaction measurements change caused by EDGAR

Several pre-EDGAR studies [French and Roll, 1986; Abarbanell and Bernard, 1992] speculate whether the filing/price relationship is a plain correlation, or whether in fact it is limited to co-occurring events, such as earnings data published in proximity to annual filings. Measuring theories and frameworks [Hirshleifer and Teoh, 2003; Gifford et al., 2009] suggest means to settle this, by utilizing filings impact measurements using past returns (in which no voluntary data was published), and using unexpected returns as a target variable, hence attempting to mitigate expected/market-wide outcomes and isolate the publication's impact.

Though late filers are argued to typically face significant economic events which count for the delayed filings of reports [Frost 1997], it may be suggested that dealing with early or on-time filers requires different measuring models, since as mentioned different types of investors are participating in trade differently within late, on-time and early reports. A filing related example for metadata usage is negative deadline proximity (a report delivered

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after the due date). Whether the source of late filing is for strategic reasons such as keeping the stock price high as long as possible before breaking problematic news to the public, or failing to meet the delivery due date from administrative reasons, the reason a report was filed late can direct an investor into a different type of reading, resulting in shifting in aggregate reaction of investors. As indicated by Li et al. [2009], pre-EDGAR academic research has yielded mixed conclusions as for market reactions to the periodic SEC related filings. It may by argued that these conclusions are attributed to a non-seamless data dissemination environment, and the relative difficulty of obtaining information (by investors), in comparison to the post-EDGAR era. When relating to the notion that EDGAR has caused a shift in market reaction to filings and controlling it by dealing only with post-EDGAR data, results in models proved to stay inconclusive, indicating at times that the market reaction for filings is restricted both in magnitude and duration [Li et al., 2009], and indicating that the annual filing is "a significant event" which do have notable impact on investors [Griffin, 2003b; Bryant-Kutcher et al., 2013]. Griffin [2003b], measuring significant price reactions related to filings comes in contrast to pre-EDGAR models done by Han et al. [1992] which indicate that the market already incorporates the disclosures which are made in annual filings before the actual filing date.

As stated by Li and Ramesh [2009], there is a clear distinction between research conducted over the pre-EDGAR market, and the research that was done afterward. The difference may be attributed to at the amount of mixed market reactions which were found in the analyzed data. Research that is pre-EDGAR [Cready and Mynatt, 1991; Stice, 1991; Swaminathan, 1991] detect mixed market reactions as a common characteristic. The transition toward using EDGAR was subject for research by Asthana and Balsam [2001], indicating that the requirements and regulations of an automated filing process (as done in EDGAR) resulted in a rather timelier and ordered information dissemination, which serve as a major contributor to the Form 10-K filings relevance, and for mitigating the mixed market reactions detected previously [Cready and Mynatt, 1991; Stice, 1991; Swaminathan, 1991].

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5. CHAPTER V: METHODOLOGY

5.1 PREFACE

The notion used as a guideline throughout this study is the ability to produce beneficial insights from measurements of past events. Estimating the Form 10-K reports relevance for investors requires measurements of an equation with two sides:

On one hand, the information which investors are exposed to, residing in Form 10-K reports. On the other hand, investors' reactions, manifested in trade movements (shares performance and volume) observed at the stock exchange.

The methodology requirements are formed to enable the following two measurements:

- **Measurement of information** (residing in Form 10-K reports), allowing the precise and consistent assessment of narrative free- text readability, while being to controlling diversities (being unstructured).
- **Measurement of reaction** (by investors) provides a benchmark for assessment of publication influence, perform ranking to account for inter-industry volatility differences (for example, traditional and mature industries vs. high risk/volatility industries), and considering for NASDAQ composite changes.

The methodology is made from the following five implementation steps:

- **Step A:** sampling process of the trade figures side of the equation - the performance and volume movements observed in NASDAQ and values of the Composite index[46].

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[46] NASDAQ Composite: serving as one of the top popular indices at the US stock market (as the Dow Jones and S&P 500), this index is relating to securities listed under NASDAQ (retrieved from http://www.nasdaq.com/).

- **Step B:** sampling the information side of the equation - metadata and content of Form 10-K reports sent to the stock exchange by public firms. This step contains issues as integration to EDGAR computerized interface, download of transmissions, a rigorous filtering process, and unstructured free-text extraction of text inside the Form 10-K reports.

- **Step C:** creating a unified dataset merging by datasets of both prior steps. In addition for processing both performance and volume figures in relation for the Form 10-K publication event (thus, relative to the publication time), this step includes several measurement techniques (ranking, aggregated and differential figures) implemented on the data.

- **Step D:** processing attributes of Form 10-K reports, divided into two main groups of intrinsic and external attributes (See Terms chapter for elaboration on intrinsic and external attributes). This section includes a secondary filtering process conducted on the unified dataset (product of step C), in order to filter outliers and other sources of bias.

- **Step E:** creation of a final dataset structure, built in two separate sections (publication based, ranking based), which is used at the analysis stage.

- **Step F:** clustering: using an expectation maximization algorithm to group reports into segments, by both external and intrinsic attributes.

Results analysis methodology: having sampled all measurement relating to Form 10-K reports and their respective response among investors, analysis is conducted in three main categories:

- **Effect:** variable characteristics, reciprocal relations between variables.
- **Grouping:** characteristics unique for specific groups (for example, first-tier auditors).
- **Trends:** consistent courses showing multi-year growth/reduction (within both report attributes and the market environment).

5.2 STEP A: TRADE DATA COLLECTION

5.2.1   Sampling NASDAQ share quotes and trade volumes

NASDAQ daily trade figures for 2005-2015 are obtained from two separate data providers, in order to cross-check and validate figures. Representing the public available sources, figures are obtained from Yahoo finance database, using the proprietary API mechanism available publicly. In addition, data is obtained via EODData LLC, which offers custom databases by demand. Figures on both datasets mentioned reside on a daily resolution for each ticker, holding opening and closing quotes, and trade volume.

For the purpose of processing adjusted returns, performance data regarding NASDAQ Composite for the relevant period was also gathered, in daily resolution.

Calculating daily percentage differences: in addition for downloading said data, a calculation process of daily change in percentage is added, relying on opening and closing figures while relating for days without trading activity. This calculated figure is later used for additional aggregate figures within designated timeframes (elaborated in step C).

Calculating history based volatility figures: values (performance, volume, volatility) of an individual stock may be measured in respect not just to other stocks, but also in respect to historical values of the stock itself. Some stocks are more (less) volatile by nature, and present larger (smaller) values routinely, relative to other stocks.

In order to examine the influence of Form 10-K publications, the registered performance and volume changes should be measured not just as a standalone value, but also in respect to historical values of the same stock. For example, two stocks showing a 10% performance growth within 3 days after publication may prove very different, if one is constantly showing this scale (~10%) of performances (whether positive or negative), while the other traditionally shows very low figures.

In order to address this issue, in addition for calculating performance and volume figures, returns are accompanied with volatility indicators, showing the change in volatility which
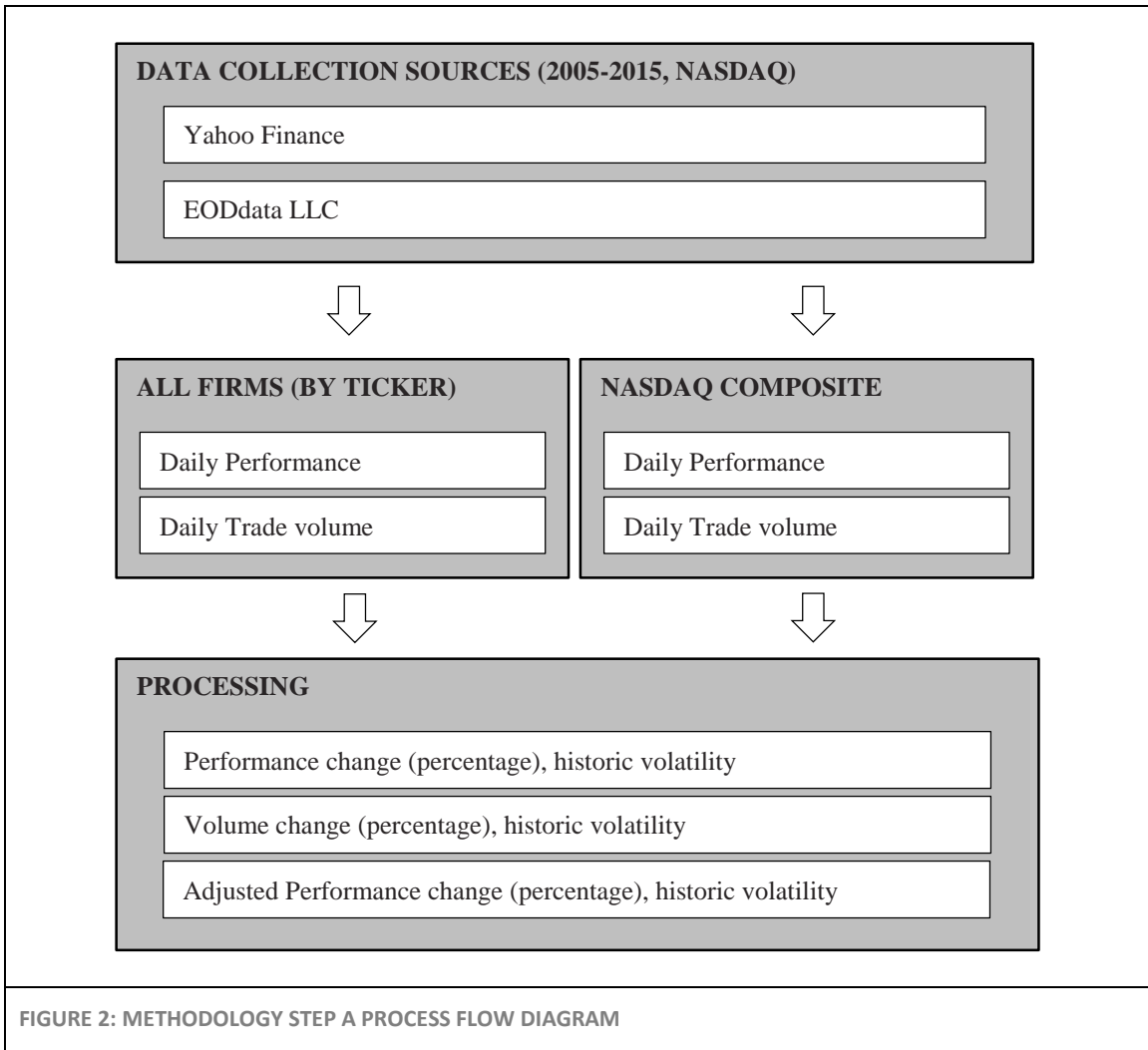
values present in relation for the historical values of the specific stock. This measure is obtained using the calculation of relative standard deviation (Coefficient of Variation). It is a standardized measure of dispersion, showing the specific values relation with prior mean and standard deviation of the past one year values measured on the same stock.

Figure 1 shows an example of the relation between performance and performance volatility indicators at 3 days post-publication, point A is located at 0.6,16, point B is located at 0.6,38. As Illustrated, performance may (naturally) have positive and negative values. These values are measured in relation for historical performance data, and use as a volatility benchmark. As seen in figure 1, the two sample points A and B have approximately the same performance (PA3) indicator (at 0.6%). However, they have different performance volatility (PA3_RSD) value. The value on the right (point B) comes from a distribution (stock past performance) which has less volatility (meaning, was moderate) than the value of the left (Point A). Therefore, this indicates that the same 0.6% performance value for the two stocks actually shows a much larger effect at the stock represented on the right (point B), since it is rarer and represent higher impact, on a stock which usually show smaller scale performance figures. Said higher impact in realized in the volatility indicator, illustrated in figure 1 (X axes, PA3_RSD variable), showing that the same 0.6% figure for firms A and B has a different (16, 38 respectively) value of volatility, which in turn indicates a larger volatility for firm B, for which a 0.6% figure is much scarcer.

FIGURE 1: SAMPLE FIRM DIFFERENCES BY COEFFICIENT OF STANDARD DEVIATION
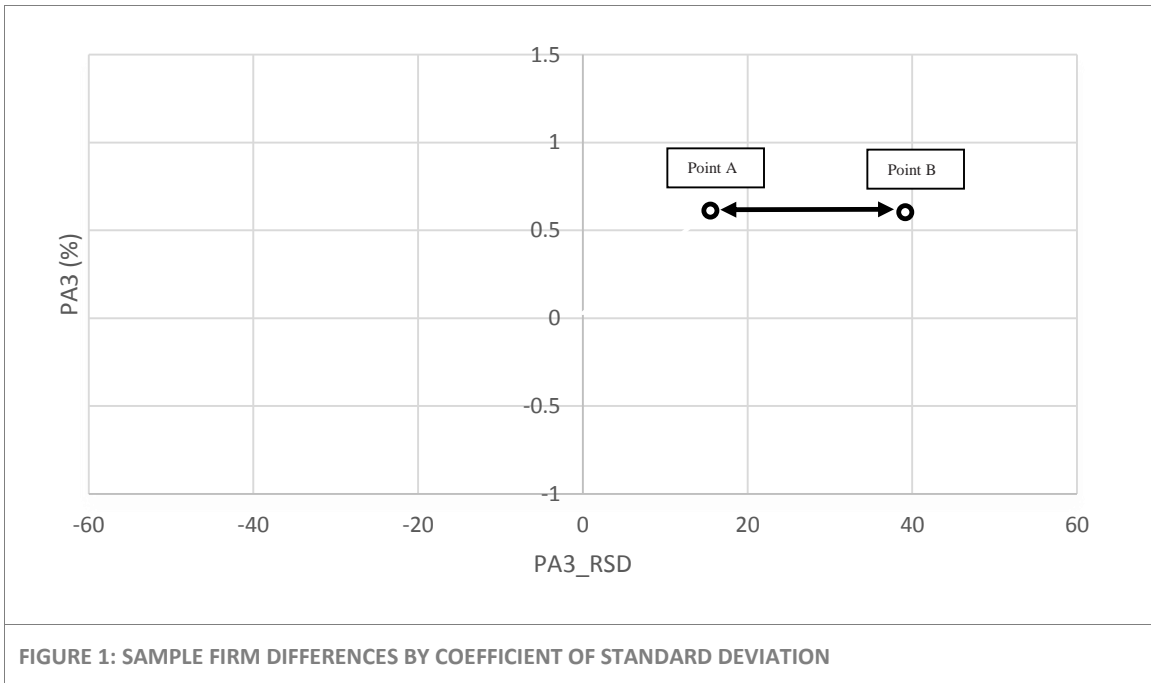
5.2.2   Process flow diagram: Step A

Figure 2 illustrates the process flow of the first step. Data is collected from two sources of information, concerning both NASDAQ composite and firm level figures for all trading firms. This data is later processed to show performance and volume changes. Adjusted performance change shows excess performance on top of the daily reported change within NASDAQ Composite.

DATA COLLECTION SOURCES (2005-2015, NASDAQ)

Yahoo Finance

EODdata LLC

ALL FIRMS (BY TICKER)

Daily Performance

Daily Trade volume

NASDAQ COMPOSITE

Daily Performance

Daily Trade volume

PROCESSING

Performance change (percentage), historic volatility

Volume change (percentage), historic volatility

Adjusted Performance change (percentage), historic volatility

FIGURE 2: METHODOLOGY STEP A PROCESS FLOW DIAGRAM

5.3 STEP B: SEC EDGAR DATA COLLECTION

5.3.1 Integration interface and transmissions collection

SEC EDGAR offers a free database and access interface for transmissions of over 500 different types of forms and transmissions made by all firms[47]. EDGAR serves not just as

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[47] Retrieved from US Securities and Exchange Commission online information center, available at www.sec.gov/about.

a channel for transmissions and storage, but also conducts a rigorous process of validating the transmissions structure for ensuring adherence of transmissions for set regulations and standards. Data transmitted by parties is indexed using industry common methods (firm tickers[48]) as well as internal indexes (CIK[49]) used for accurate identification of the submitting party, date of transmission and attributes relating the status of the filing. Files submitted to EDGAR are availably publicly via a web interface, and via a standard FTP protocol (allowing direct file access).

Over the time frame set for this study (2005-2015), EDGAR offers access to over 10.5M transmissions[50]. EDGAR holds full indexes of all filed transmissions on a single quarter resolution: the transmissions content for each individual quarter are saved separately on EDGAR, so in order to collect the required dataset, a download iteration is conducted for all 40 quarters (10 years by 4 quarters).

After downloading the Meta files (quarterly resolution indexes), their content was extracted. Each Meta file contains a single file, with an IDX extension. In turn, every IDX file contains a list of transmission filenames, and is accompanied with a unique company identifier, which is called CIK. The list of transmissions at the IDX file states the specific type of transmission made by the company.

For illustrating a transmission content, a single line of an IDX file have the following attributes:

1. Internal CIK (for example, 1000045).
2. Firm name (for example, NICHOLAS FINANCIAL INC).
3. Type of transmission (for example, 10-Q, indicating a quarterly report).

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[48] Tickers are used to uniquely identify shares of a particular firm, ticker symbols are used as a shortened abbreviations.

[49] The CIK value is an internal firm identifier which only resides at the EDGAR system. It is similar to the Ticker entity, but allows a unique identification of every transmitting company.

[50] "Filing Review Process". SEC.gov. October 16, 2015.

4. Transmission date (for example, 2008-11-10).

5. URI of transmission location on the FTP (for example, 1000045/ 0001193125-08-231247).

By iterating through all IDX files from different quarters, and parsing their relevant transmissions, a dataset is created holding 10,439,632 transmissions for the 2005-2015 time frame.

5.3.2   Filtering transmissions by attributes and metadata

A filtering process is conducted on the transmissions dataset in order to keep just the transmissions containing publications of Form 10-K reports, which are the interest of this study.

Due to the abundant transmission types (over 500 unique), the periodic annual/quarterly transmissions are just a small segment of diverse form types contained at the list of available EDGAR transmissions. The most common transmissions are Form 4 transmissions dealing with insider trading, and Form 8-K which is used to announce major events. Filtering the 10,439,632 transmissions which were made through SEC EDGAR within the selected time-frame by transmissions of Form 10-K/10-Q reduced the relevant (for this study) transmissions number to 424,408 (which are 4.06% of transmissions).

Filtering by ticker: since several stock exchanges report via EDGAR (NYSE, NASDAQ etc.) transmissions for filings are filtered for NASDAQ filings only (for the scope of this study). Out of the overall 424,408 transmissions relevant for the sample period, just 89,197 transmissions (21%) are made by firms within NASDAQ. For comparison, a figure of 73,577 transmissions (17.34%) took place within NYSE.

After obtaining all NASDAQ related Form 10-K/10-Q transmissions, an additional process of filtering is conducted by narrowing the population for just transmissions of Form 10-K type, out of a total population of 89,197 said filings transmissions. After filtering the corpus

to hold just Form 10-K files delivered within NASDAQ, the number of transmissions reduced to 19,967 filings (22.39%).[51]

Relevance date filtering: a total of 13,751 filings (71.77% of all of Form 10-K remaining transmissions corpus) were made with EDGAR registration under the first quarter (dated 31 March). Since US firms are entitled to choose their own fiscal year start[52], a portion of the Form 10-K are delivered throughout the entire year in respect to their particular firm's year-end, so additional filtering is done for keeping filings made in relation to the first quarter, with fiscal year end at 31 December.

Additional filtering is conducted in order to prevent bias from different quarter publications. As a result, all filings made on different quarters are excluded, and the corpus is reduced to 83% and reach a figure of 11,422 filings. It is important to mention that all remaining transmissions consist of Form 10-K filings specifically indicating that it is relevant for the fiscal year ending on 31 of December.

Next, all Form 10-K reports published after the deadline (whether accompanied with an NT type preliminary notice or not) are excluded. For example, transmissions with more than 90 days between the stated date (at the filing) and the actual transmission date are excluded, in order to filter small firms (adhering to the definition of SEC by having a public float smaller than $70M) regulated to issue Form 10-K publications within 90 days from the fiscal year end and late on transmission. Since only 20 publications answer to this

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[51] Form 10-K filings compose a figure of 22.39% of all NASDAQ Form 10-K and Form 10-Q related transmissions sampled (including derivative forms, amendment forms and other technical forms which do not include accounting information), surpassed by 10-Q files at 65.9%. An additional 3,755 forms (4.21%) are Form 10-K amendments (marked as 10-K/A). The rest are Form NT10-K, Form NT10-KA, Form 10-KT and Form 10-KT/A files which adds up to 1,444 transmissions (1.62%) at the selected period. As mentioned, the additional corpus filtering is done in order to keep just plain Form 10-K transmissions, hence 19,967 forms – all forms which were not strictly Form 10-K (meaning amendments, non-filings etc.) were excluded.

[52] US Congress Public law 73–291, 73d Congress, H.R. 9323, retrieved from FRASER Federal Reserve Archive.

definition and are published late than regulated deadline (a very rare situation), the number of transmissions filings database was accordingly reduced to 11,402 files.

Auditor related parsing: filings are scanned in order to extract the identity of the auditor. Auditor's signature resides on a designated part of the Form 10-K, which is called "auditor's statement". This process (having scanned all reports for auditor's identity) detected 225 filings (1.97%) which are signed by more than one auditor[53]. In order to prevent bias from such publications, they are excluded from the corpus. After filtering multiple auditors, a total of 11,177 filing remained at the transmissions Form 10-K database.

To summarize, the following filters are taken at the transmissions sampling stage in order to establish the corpus[54].

1. 10,439,632.00 total transmissions were made in 2005-2015 via EDGAR.
2. Filtering only periodic related reduces corpus to 424,408 files (4.06%).
3. Filtering only NASDAQ related reduces corpus to 89,197 files (21.01%).
4. Filtering only Form 10-K type reduces corpus to 19,967 files (22.38%).
5. Filtering only Q1 transmissions reduces corpus to 13,751 files (68.86%).
6. Filtering only reports for the fiscal year ending on 31 December reduces corpus to 11,422 files (83.06%).
7. Filtering only on-time reports reduces corpus to 11,402 files (99.82%).
8. Filtering only reports signed by one auditor reduce corpus to 11,177 files (98.02%).

5.3.3   Text extraction

The last part of step B deals with text extraction. Since the Form 10-K transmission may contain additional file attachments (encompassed within the transmission), the form itself

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[53] Multiple auditors may occur as a post-merge or post-acquisition effect, having two entities combined artificially for accounting purposes while each is having its own "legacy" auditor, or as strategic choice by the management.
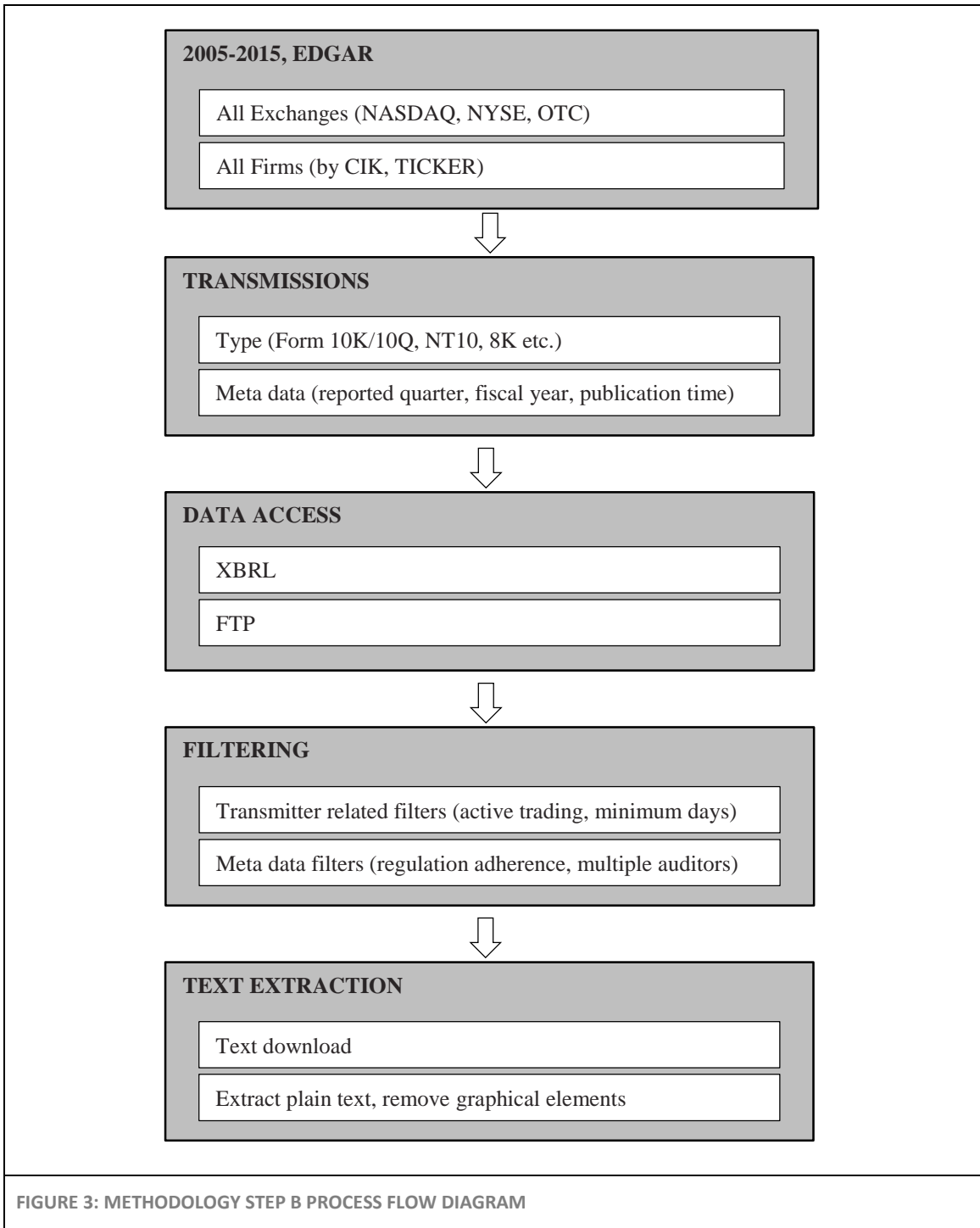
[54] Note that a second filtering takes place after combining the stock performance/volume figures and the Form 10-K transmissions (this will be elaborated in step D).

has to be isolated from other attachments at the transmission. Even after excluding the external attachments, several objects may still be embedded into the form itself, often residing in a portable document format. These objects may include formatting instructions (headlines, style sheets and bookmarks), table elements and hyperlinks. Filtering these objects is achieved by a technical procedure of text extraction which is elaborated at the technical appendix. As a pre-requisite for readability measurements (step B), the downloaded transmissions are stripped from all unique graphical tags using a designated process written in C#, leaving just the clear textual data. Note that all text residing in the said objects is preserved (for text readability measurements purposes), thus only graphical and design related instructions are removed.

The mentioned process is iterated 11,177 times, downloading all raw texts of Form 10-K transmissions for the 2005-2015, made within NASDAQ. In total, 477 Million words are extracted, averaging at 62 thousand words per report.

5.3.4   Process flow diagram: Step B

Figure 3 illustrates the process flow of the second step. First, data is collected via SEC EDGAR is unfiltered (it is originally containing transmissions of all firms, traded in all stock exchanges). Transmissions are parsed for respective type and metadata attributes related to the time of publication and reference period of the report. Data integration is made in front of the EDGAR FTP interface, using XBRL. Data collection is followed by a filtering process which is made on two different verticals (transmitter related and metadata related). After the filtering, PDF files of reports are downloaded and plain text is extracted using a C# proprietary snippet.

2005-2015, EDGAR

All Exchanges (NASDAQ, NYSE, OTC)

All Firms (by CIK, TICKER)

⇩

TRANSMISSIONS

Type (Form 10K/10Q, NT10, 8K etc.)

Meta data (reported quarter, fiscal year, publication time)

⇩

DATA ACCESS

XBRL

FTP

⇩

FILTERING

Transmitter related filters (active trading, minimum days)

Meta data filters (regulation adherence, multiple auditors)

⇩

TEXT EXTRACTION

Text download

Extract plain text, remove graphical elements

FIGURE 3: METHODOLOGY STEP B PROCESS FLOW DIAGRAM

5.4 STEP C: CREATING A UNIFIED DATASET

5.4.1 Calculating figures for designated timeframes

Since different firms may issue reports in different days, even within the same regulatory framework (for example, similar public float), measurements of figures should be relative to publication date. For example, as illustrated in figure 4, firm A issued the report on March 19th, as oppose to firm B which issued the report two days later, on March 21st. In order to benchmark both firms (and generalize benchmarking to all firms population), the figures calculation process must not deal with specific (calendar) days, but rather perform a relative measurement taken in front of the publication date. As can be seen on the example, the "Adjusted" figures at the bottom of the image align both firms by using their respective publication date as an anchor. In accordance, "Filing" indication show (sample) values of 1.14% for firm A and 2.03 for firm B. This process is repeated for all firms, by performance, performance volatility, volume and volume volatility.

Raw	15-Mar	16-Mar	17-Mar	18-Mar	19-Mar	20-Mar	21-Mar	22-Mar	23-Mar	24-Mar	25-Mar
Firm A	1.10%	1.11%	1.12%	1.13%	**1.14%**	1.15%	1.16%	1.17%	1.18%	1.19%	1.19%
Firm B	2.09%	2.08%	2.07%	2.06%	2.05%	2.04%	**2.03%**	2.02%	2.01%	2.00%	1.99%
Adjusted	-5	-4	-3	-2	-1	Filing	1	2	3	4	5
Firm A	1.09%	1.10%	1.11%	1.12%	1.13%	**1.14%**	1.15%	1.16%	1.17%	1.18%	1.19%
Firm B	2.08%	2.07%	2.06%	2.05%	2.04%	**2.03%**	2.02%	2.01%	2.00%	1.99%	1.98%

FIGURE 4: CALCULATION OF DATE RELATIVE FIGURES

Another proprietary process is performed against the dataset in order to calculate an overall share price/volume change within 3 days and 21 days past the report presentation (registered filing on EDGAR).

The mentioned process is made out of the following parts:

1. Iterating all available quotes on the **quotes dataset**, loading the following data for each entry: daily price change in percentage, relevance date, firm (ticker) and registered volume of trade.

2. Iterating all filings at the **Form 10-K dataset**, and applying the daily change and volume calculations.

3. Iterating all results of the NASDAQ composite daily change (in percent).

4. As done in computing adjusted figures (single day), in order to compute aggregate (several days) figures, the algorithm should not only relate to the filing date as a start point (anchor) for calculation, but also relate to days of trade activity which differ between years (due to public holidays and similar non-trading periods). This is achieved by sorting quotes and volumes by date, and iterating just the dates following the filing date which are not later than the desired period and are open for trade. For example, a 21 days calculation for a file presented at March 1st 2014 (relating to fiscal year ending on 31 December 2013) will relate for movements made between March 2nd (due to 24 hours filing gap of EDGAR) and March 22nd, and compute aggregate figures for all active days within the mentioned period. If the 21 day period has 2 weekends (4 non-trading days) and one holiday (1 non-trading day), only 16 days actual trading figures are calculated.

5. Every quote calculated in the previous section is measured against the extent of the NASDAQ composite for the relevant day. This allows obtaining a figure of adjusted (negative and positive) performance in relation to the overall performance at NASDAQ on the specific day.

The results of this stage are aggregated figures, measured in four different dimensions (performance, performance volatility, volume and volume volatility), for the mentioned time frames (meaning, 3 and 21 days).

5.4.2   Calculating daily pre-publication and post-publication figures

In addition for calculating aggregated figures for designated timeframes consisting of several days' period (as elaborated at the previous section), calculation of figures is

conducted in a daily resolution, as a preliminary measure for ranking process. A selection of 14 days as a time reference unit of measurement is taken, starting at 14 days prior to the publication date and expanding to 14 days after the publication, hence encapsulating 28 days of measurements for every firm. Choosing a 14 days span is adopted since it was previously indicated as suitable for a daily trade ranking [Miner et al., 2012], and since it represents a midway point between short-term (3 days) and long-term (21 days) measurements used.

As conducted with aggregated time-frame figures, non-aggregated figures production use the same measuring elements: for each of the said 28 time-frames, different dimensions are calculated (performance, volume and their volatility). **The non-aggregated single day timeframes are calculated in relation to the publication date, so a comparison can be made on a daily resolution for all firms, regardless of the fact they may issue reports in different days.**

5.4.3   Ranking daily figures

There are several problems deriving from comparing firms while relying only on their respective publication date. For example, there are certain industries which may prone for larger performance volatility (as the IT industry [Choudhary et al., 2014]), while other industries may prove less volatile (for reasons of mature/traditional market, with less changing attributes). In addition, certain industries and groups may be exposed for specific external events more than others, such as the BP crisis effect on the energy market, and the Enron effect on Anderson's (Enron's auditor) clients.

As an outcome of reasons mentioned, different inter-industry reactions may skew results when comparing publication effect over performance. The ranking solution proposed in this study is also performed in several previous studies [Miner et al., 2012] which demonstrated that inter-industry and effects of external events may be mitigated by implementing a ranking mechanism. The ranking process uses a separate scale for each set of figures inspected, and orders (ranks) them in reverse order (the highest value has the lowest rank of 1).

Adjusted	-5	-4	-3	-2	-1	Filing	1	2	3	4	5
Firm A	1.09%	1.10%	1.11%	1.12%	1.13%	**1.14%**	1.15%	1.16%	1.17%	1.18%	1.19%
Firm B	2.08%	2.07%	2.06%	2.05%	2.04%	**2.03%**	2.02%	2.01%	2.00%	1.99%	1.98%

Ranking	-5	-4	-3	-2	-1	Filing	1	2	3	4	5
Firm A	11	10	9	8	7	6	5	4	3	2	1
Firm B	1	2	3	4	5	6	7	8	9	10	11

FIGURE 5: CALCULATION OF RANKING (SAMPLE)

A sample ranking process is illustrated in figure 5. As demonstrated, the adjusted values of firm A show that performance figures are following an upward and consistent trend. The highest value is 1.19%, registered on day 5 after the publication. In accordance, the ranking (shown on the ranking section) shows the value of 1 at the 5th day after publication, indicating it is indeed the day with the highest performance.

Since benchmarking is needed for all publications within a 28 days' time-frame (14 days prior to publication to 14 days post-publication), the ranking is conducted using a scale of 28 ranks, each indicating the rank position for a single day in relation to other days. As done with the previous measurements, ranking process is iterated in different dimensions (performance, volume and their volatility), for all the mentioned time frames (28 in total).

5.4.4 Aggregated rankings

After completing the ranking process for each day before and after the publication date, it is possible to create aggregated rankings which represent combined rankings on both sides (pre/post) of the publication date. This is achieved by using the average value of ranks for each period (average pre-publication rank and average post-publication rank).

Creating these variables offer means to create a "delta inter-publication ranking" variable, which indicates the extent in which the average ranking is affected by publication. It should be noted that since the ranking scale is reversed in nature (smaller ranks means higher figures), a positive delta inter-publication ranking signifies a negative impact. For example, if the average pre-publication rank is 5, and the average post-publication rank is 9, the delta in rankings (delta inter-publication ranking) is 4, meaning actual figures (whether performance or volume related) were higher prior to the publication, and were lower afterward. All said variables (pre-publication ranking, post-publication ranking, and delta inter-publication ranking) are calculated iteratively in two different dimensions (performance, volume) for all the publications at the filtered corpus.

5.4.5   Process flow diagram: Step C

Figure 6 illustrates the process flow of the third step. Trade data is crossed against publication data to create a publication date relative dataset of both daily and multi-day figures. In addition, ranking process takes place with three separate outcomes – daily figures, aggregated figures and pre/post publishing differences.

ITERATING FOR ALL FORM 10-K REPORTS

PUBLICATION RELATIVE FIGURES

Designated time-frames (3 and 21 days)

Daily Time frames (-14 to +14 days from publication)

TYPES

Non relative figures

Adjusted returns

DIMENSIONS

Performance (+volatility)

Volume (+volatility)

RANKING

Rank daily time frames (-14 to +14 days from publication)

Aggregated rankings

Delta inter-publication ranking (pre/post publication)
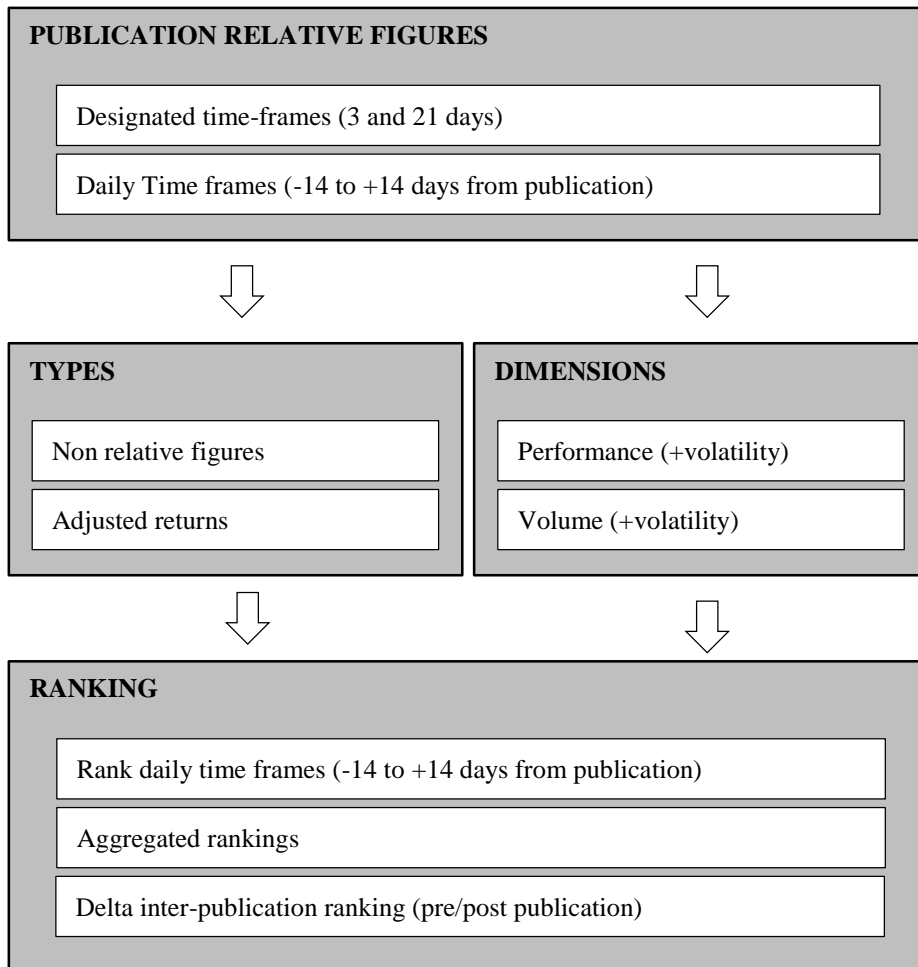
FIGURE 6: METHODOLOGY STEP C PROCESS FLOW DIAGRAM

5.5 STEP D: ATTRIBUTE PROCESSING, POST-HOC FILTERING

5.5.1 Form 10-K attributes

In order to measure the nature of impact which Form 10-K have on investors, this study makes a distinction between two types of attributes – intrinsic and external. Intrinsic attributes (as their name suggests) depend only on the report itself, and doesn't relate to external events. The intrinsic attributes are parameters calculated from the text of the report, and act as Meta-data on top of the content, describing complexity and readability of the text itself for potential readers. On the opposite, the external attributes are not intrinsic but rather exist within a particular context, deriving from different parties as regulatory authorities, other firms and auditors.

FIGURE 7: FORM 10-K ATTRIBUTE SUB-GROUPS
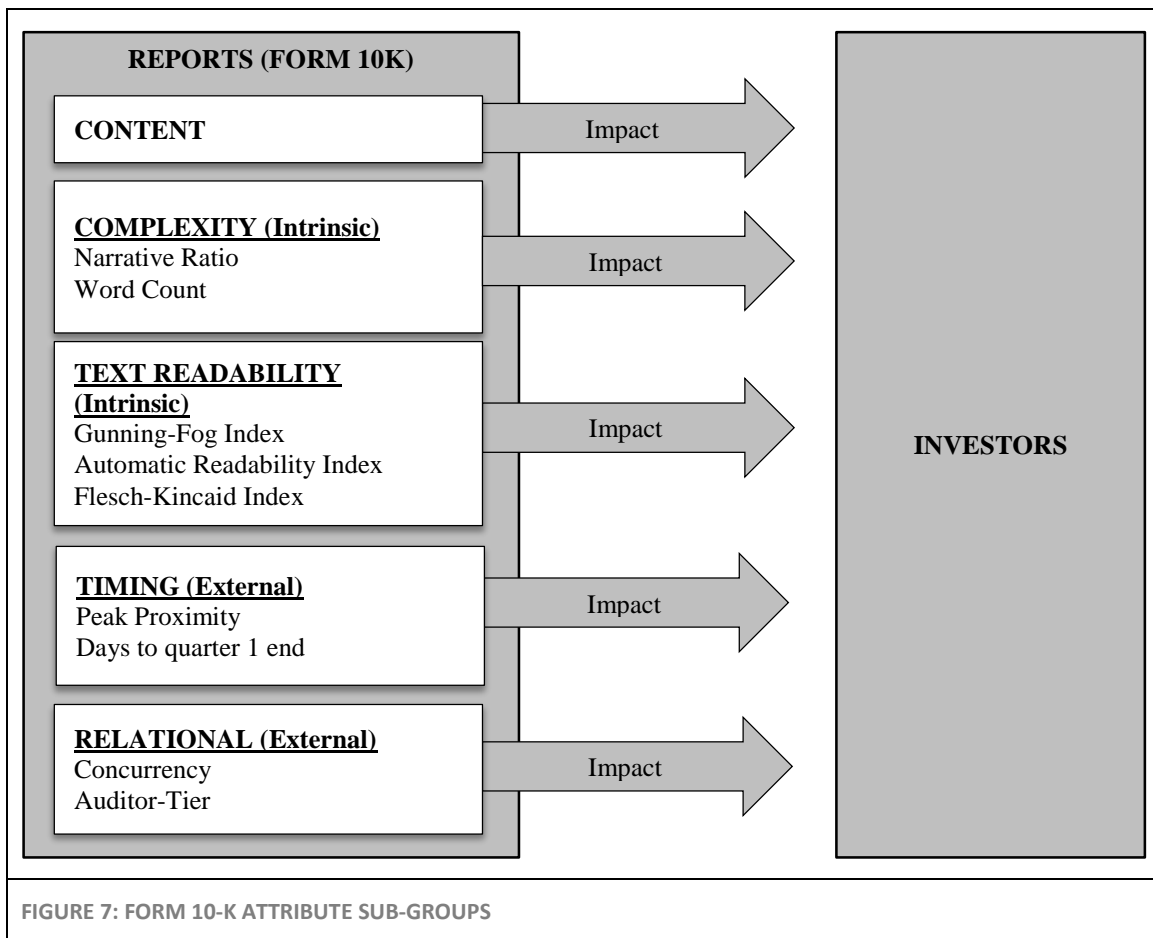
5.5.2   Calculating Form 10-K intrinsic attributes

Intrinsic attributes act as Meta-data on top of the text content of the Form 10-K. These attributes include the following groups: complexity attributes and text readability attributes.

The complexity attributes group consist of a narrative ratio indicator, which measures the ratio between the narrative part of the reports (thus, written textual content) and figures/tables part (indicating numbers residing in figures and tables). As the narrative ratio increases, it indicates that the said ratio is leaning toward the narrative[55], meaning the Form 10-K report has larger words to figures ratio. The second indicator within the complexity group is the word count indicator, which counts the words inside a document.

5.5.3   Calculating Form 10-K external attributes

External attributes act as an indicator for parameters related to the Form 10-K which does not derive from its text content. These attributes include the following attributes groups: timing attributes, and relational attributes.

The timing attributes group consist of a peak proximity indicator and a "days for quarter 1 end" indicator. The first is a measure in days for the time span between the day in which the Form 10-K was transmitted to the stock exchange, and the closest regulated deadline (determined by SEC as an outcome of the firm's respective public float). The second indicator is a measurement of days left to the end of the first quarter from the date the Form 10-K transmission took place.

It should be noted that the term "Peak Proximity" refers to the closest peak of publications, either 60, 75 or 90 days past the beginning of the year. Indeed, firms are regulated to issue the Form 10-K reports to a specific date, based on their public float. However, a firm which

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[55] Data presented in this study show annual Form 10-K report at the examined time-span has a Narrative ratio mean of 0.923, median of 0.927, and that values are between a minimum of 0.803 and a maximum of 0.979.

publishes a Form 10-K ahead of time (an act which is permitted by regulations), may mix with other reports being published at the last day, differing by their size. For example, a medium sized firm regulated for publishing at 75 days may publish the report 15 days ahead of time, together with large sized firms regulated for publishing at 60 days. Hence, the peak proximity should be set at 0 days of both firms (distance to closest peak) and not in respect to the specific deadline proximity (15 days for firm B, 0 days for firm A). The relative peak proximity calculation is illustrated in figure 8. Two firms with very similar public float, one slightly above SEC threshold (firm A) and one slightly below it (firm B). For an unsophisticated investor (either unaware of the threshold itself, or unaware of the two firm's respective values), a filing made on the same day may be interpreted equally, although one firm (B) is actually making an early presentation in 15 days.

Firm A
Public Float: $705M
SEC Form 10-K deadline: 60 days

Firm B
Public Float: $695M
SEC Form 10-K deadline: 75 days

Both firms publish on the same day, at 60 days

Firm A
Individual Peak Proximity: 0 days
Relative Peak Proximity: 0 days

Firm B
Individual Peak Proximity: 15 days
Relative Peak Proximity: 0 days

FIGURE 8: INDIVIDUAL AND RELATIVE PEAK PROXIMITY DIFFERENCES
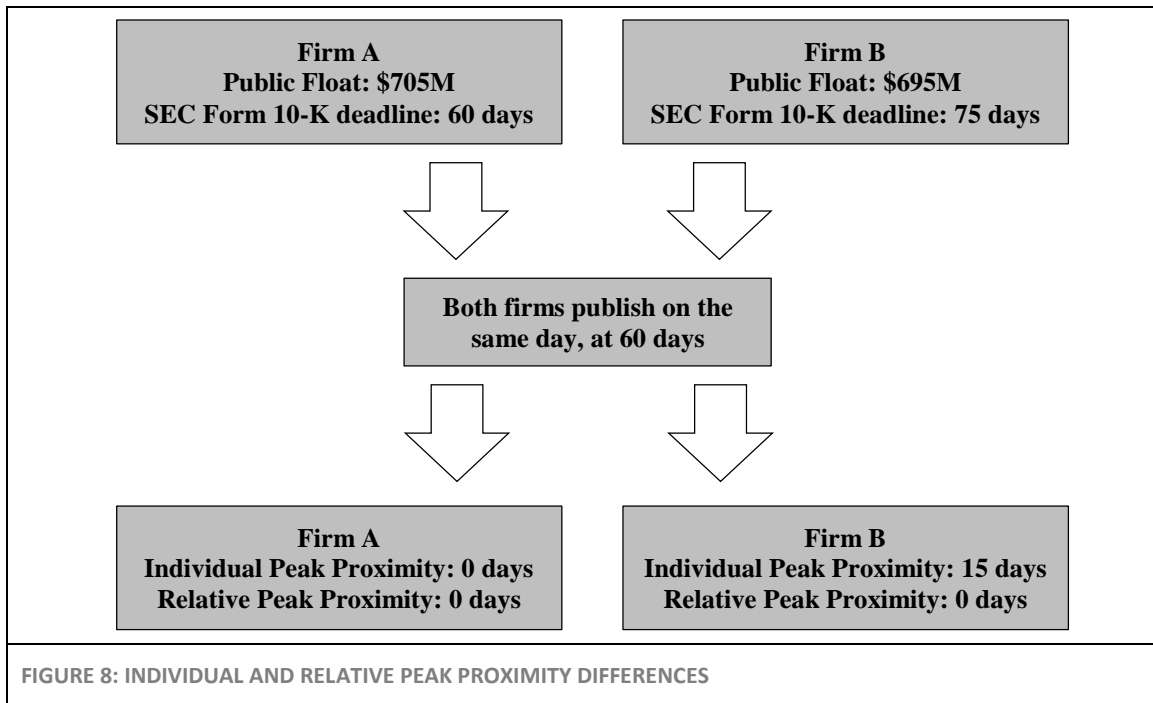
The relational attributes group consist of a concurrency indicator and an auditor-tier indicator. The first is a measure of the number of Form 10-K transmissions made in the same day (thus, representing unique firm transmissions). This measure signifies the load of publications within a particular day. It should be noted that since firms tend to publish

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Form 10-K reports at the close vicinity of regulated deadline [You and Zhang, 2009], hence, in peaks, there are certain days (the public float dependent deadlines dates at 60, 75 and 90 days) in which this measure is particularly high. Another relational attribute is the auditor indicator. This indicator is measured as a dichotomous variable indicating first-tier of auditors membership of the audit firm signing and auditing the Form 10-K.

5.5.4   Post-hoc filtering

Once completing all steps required to create a unified dataset, containing both Form 10-K publications (including their respective intrinsic and external attributes) and NASDAQ trade figures, a second filtering process is conducted in order to minimize bias deriving from outliers.

Additional filtering is done, narrowing the scope for just reports made by firms which are actively trading for at least 60 days within the examined quarter. This filtering reduces the corpus count to 8,781 filings (78.56% of 11,177 available filings).

In order to remove outliers that may skew the final output, a calculation of mean and standard deviation was performed for each of the impact related measures (daily data of performance, performance volatility, volume and volume volatility, rankings and absolute figures), and a range of 3 standard deviations[56] from the mean was set as the allowed range. Any figure not within this range is considered as an outlier. Filtering the combined quotes /filings dataset by 3 standard deviations, over all selected figures mentioned reduces the dataset from 8,781 filings to 8,301 filings (94.53%).

Additional filtering by word count is conducted in the same manner, and lead to removing 126 reports from the corpus due to exceptionally short Form 10-K, and removing 30 reports

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[56] Selection of 3 standard deviations as an outlier's measurement unit was done in previous research relating to stock exchange related performance [Asthana and Balsam, 2001].

from the corpus due to exceptionally long Form 10-K, setting the range of words length at 12,149 word for the shortest report in the corpus and 199,394 words for the longest report.

8,138 files (98.03%) remain at the corpus after the word count filtering processes. As a final measure, Coefficient of Variation for both price and volume within time frames of 3 and 21 days is also filtered by 3 standard deviations, leaving 7,618 files from 8,138 (93.61%).

To summarize, the following posthoc filters are taken after the combined dataset creation, in order to establish the final corpus (the initial state of 11,177 Form 10-K transmissions are present at the start of the posthoc filtering process):

1. Filtering only 60 days active traders reduces corpus to 8,781 filings (78.56%).
2. Filtering daily figures by 3 standard deviations reduces corpus to 8,301 filings (94.53%).
3. Filtering word count outliers by 3 standard deviations reduces corpus to 8,138 filings (98.03%).
4. Filtering aggregated figures by 3 standard deviations reduces corpus to 7,618 filings (93.61%).

The final corpus for the study, after going through all the filtering measures, has 7,618 Form 10-K report publications.

5.5.5 Process flow diagram: Step D

Figure 9 illustrates the process flow of the fourth step. At first, attributes are created for each Form 10-K, in separation for intrinsic attributes and external attributes. After calculating values for each attribute, the entire dataset is filtered for outliers deriving from both performance and reports related attributes.

FIGURE 9: METHODOLOGY STEP D PROCESS FLOW DIAGRAM
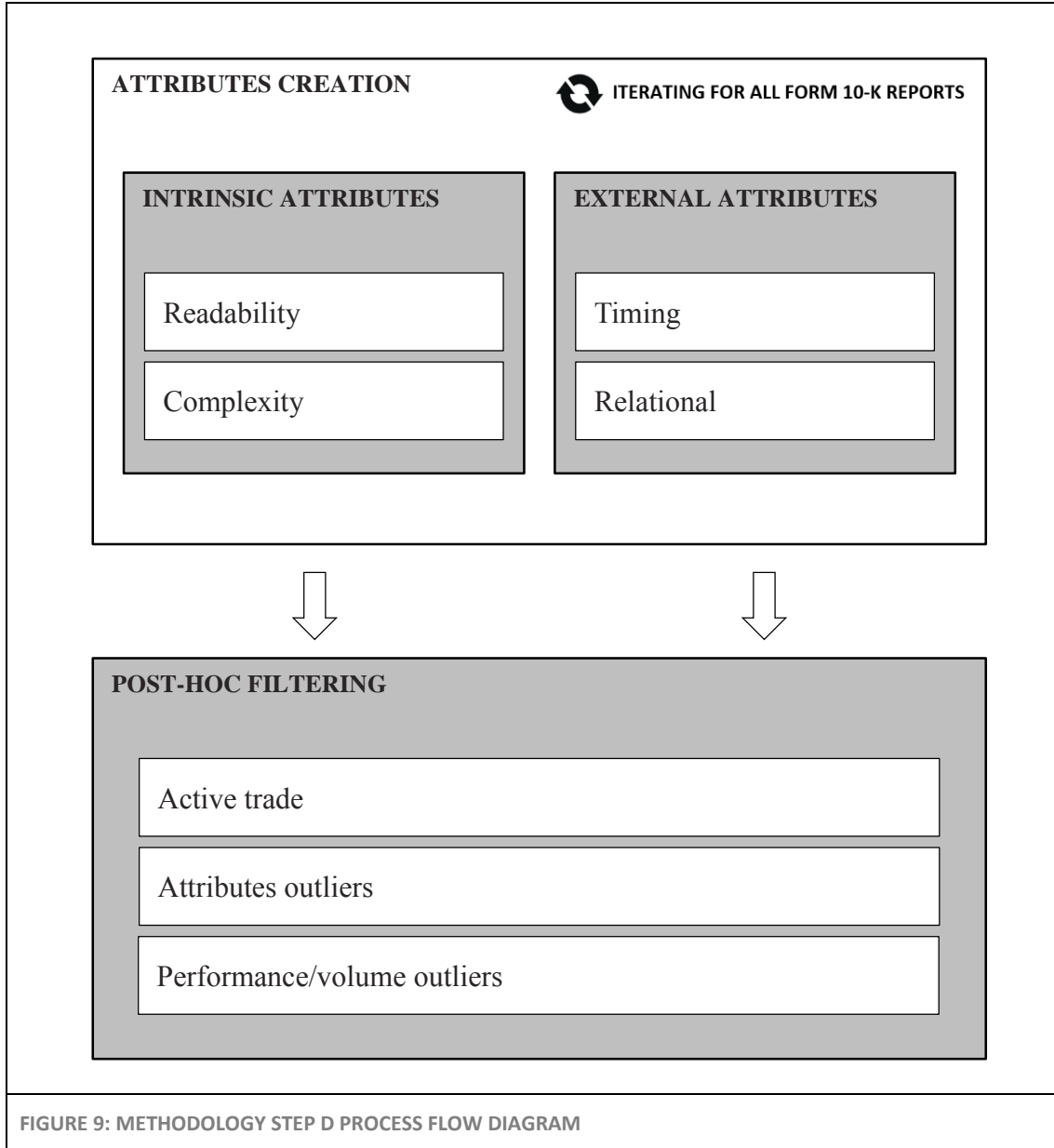
5.6 STEP E: DATASET FORMULATION

The final stage of the methodology conducted in this study is to create a dataset which is used at the analysis. Having sampled all measurement results relating to Form 10-K reports and their respective response among investors, the dataset is structured to contain the following two parts:

- **Dataset A**: Publication based
- **Dataset B**: Ranking based

Dataset A

Publication based dataset: this dataset includes all available attributes for a single Form 10-K publication. As illustrated on figure 10, it holds publication relative performance, volume and Form 10-K attributes (intrinsic and external).
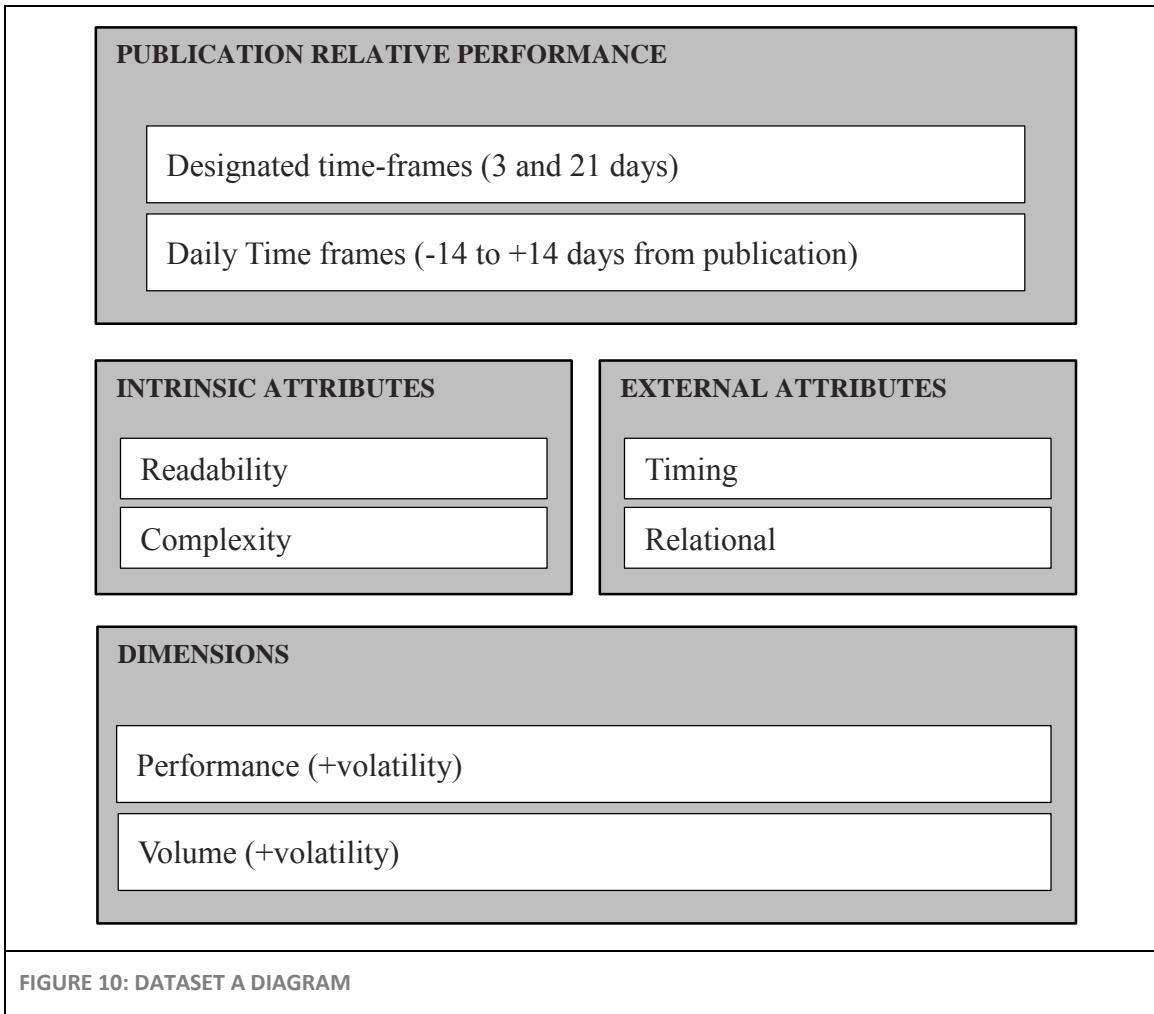
Dataset B

Ranking figures dataset: as illustrated in figure 11, this dataset is designated to allow comparison of ranks made from 14 days prior to the publication event to 14 days after the publication.

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FIGURE 11: DATASET B DIAGRAM
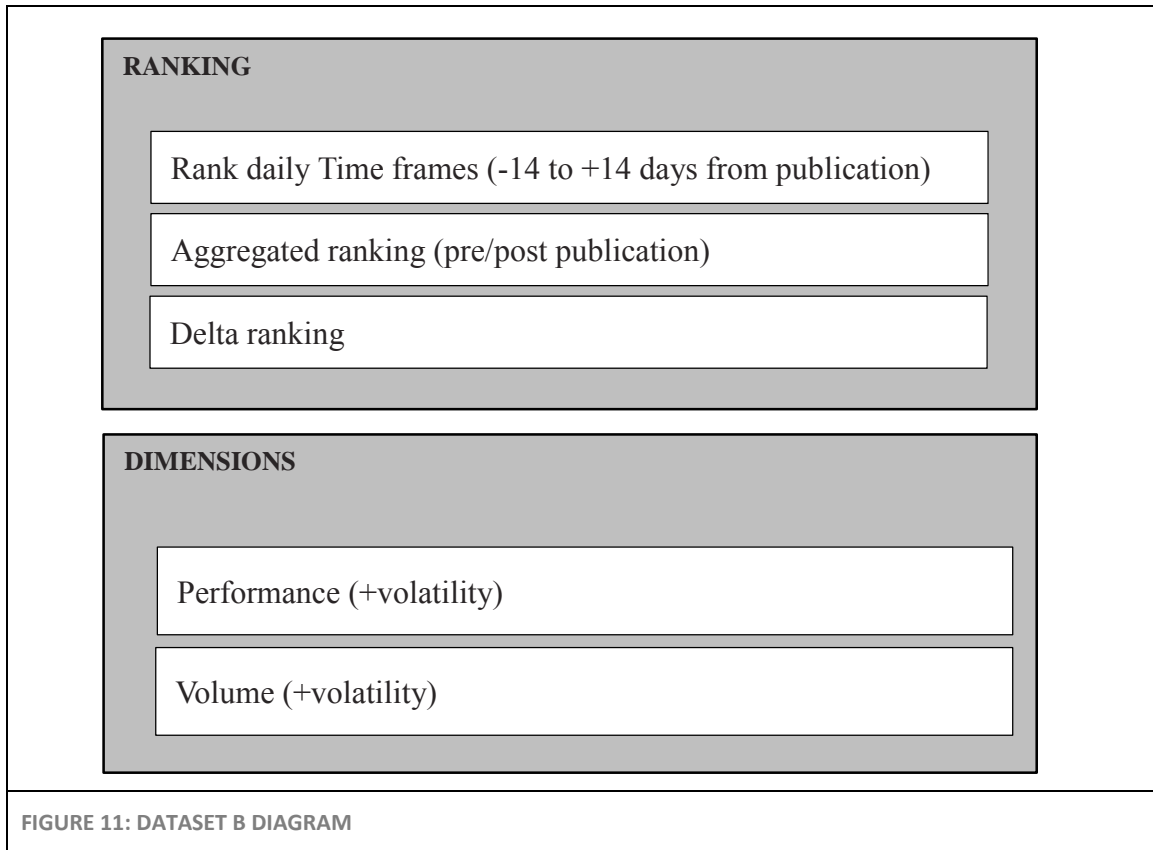
5.7 STEP F: CLUSTERING OF EXTERNAL AND INTRINSIC ATTRIBUTES

5.7.1 Clusters creation process

In order to examine the influence of the different Form 10-K attributes on trade attributes in general, and the respective impact of intrinsic and external attributes in specific (while relating to short-term and long-term effects), the following clustering process is conducted: An expectation maximization algorithm is implemented in separate for all intrinsic attributes (readability, complexity) and for all the external attributes (timing, relational). This process is an iterative process which allows locating the maximum likelihood of attributes. The composition of external and intrinsic clusters is illustrated in tables 1 and 2. The arrows at the tables illustrate growth directions of values in between the different clusters.

TABLE 1: EXTERNAL ATTRIBUTE BASED CLUSTERING

Variable		Cluster 1	Cluster 2	Cluster 3	Cluster 4
Cluster Size		219	3256	1314	2829
PP: Peak Proximity	Mean	**18.57**	**6.87**	**6.77**	**0.47**
	Std. Dev	4.919	3.65	4.73	0.57
DQ: Days to quarter 1 end	Mean	**48.57**	**22.33**	**22.00**	**17.31**
	Std. Dev	4.919	11.09	7.42	10.08
CN: Concurrency	Mean	**3.54**	**22.56**	**70.78**	**91.59**
	Std. Dev	1.835	10.72	22.89	36.06
B4 : First-Tier		76%	56%	62%	56%

TABLE 2: INTRINSIC ATTRIBUTE BASED CLUSTERING

Variable		Cluster 1	Cluster 2	Cluster 3	Cluster 4
Cluster Size		1561	2359	2307	1391
FOG	Mean	**18.063**	**16.959**	**16.152**	**15.067**
	Std. Dev	0.584	0.300	0.316	0.593
ARI	Mean	**15.724**	**14.460**	**13.482**	**12.369**
	Std. Dev	0.626	0.333	0.351	0.785
FK	Mean	**10.082**	**9.097**	**8.317**	**7.317**
	Std. Dev	0.527	0.260	0.262	0.571
WC	Mean	**68599**	**66107**	**59064**	**55976**
	Std. Dev	37536	33497	29456	31455
NR	Mean	**0.939**	**0.927**	**0.918**	**0.910**
	Std. Dev	0.021	0.020	0.020	0.023

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5.7.2 Clusters analysis

The characteristics of the external clusters are based on the load they create by the publication timing. Referring to Peak Proximity, cluster 1 is the farthest (18.57 days in average – table 1, row 2) and cluster 4 is the closest (0.47 days).

In accordance, Concurrency of cluster 1 is the lowers (3.54 concurrent reports on average on the same day) versus 91.59 reports on average on the same day (table 1, row 6).

Cluster 1 has a relative concentration of first-tier auditors (76%), while the other clusters present lower values (56%-62%, table 1, row 8).

The characteristics of the intrinsic clusters are based on the readability and complexity they present for a potential reader. Cluster 1 contains the publications which are the hardest to read, with readability values of 18.06, 15.72 and 10.08 for FOG, ARI and FK accordingly (table 2, row 2).

On the other hand, Cluster 4 contains the publications which are the easiest to read, with readability values of 15.06, 12.36 and 7.31 for FOG, ARI and FK accordingly (table 2 column 4). This clustering applies also for the length of reports, ranging from a mean of 68599 in cluster 1 to 55976 in cluster 4.

Finally, narrative ratio values present similar characteristics, ranging from 0.94 for complex publications in cluster 1, to 0.91 for less complex publications in cluster 4 (table 2, row 10).

6. CHAPTER VI: RESULTS

6.1 PREFACE

This chapter is built from several sections, analyzing the findings relating to Form 10-K attributes, market trade figures, and their relations.

In addition for listing relevant variables, their distribution and unique features, a battery of statistical tests are applied to determine whether or not they follow a yearly trend, and what are the differences for each variable within the first-tier audit group. Each statistical test is accompanied with a relevant figure for illustration. In addition, histograms and boxplots are available at the appendix for each variable, to demonstrate its exact characteristics.

Dependent interval and ratio scale variables with normal distribution were tested against nominal independent variables using independent-samples T-Test and ANOVA (for several categories), with Levene's Test for Equality of Variances as a preliminary step. For significant ANOVA results, a Scheffe test is conducted as a post hoc test for detecting specific variable influence within a group. Linear regression models are accompanied by an ANOVA to compare clusters of different attribute groups (see section 5.7.1 for elaboration).

Finally, a hypothesis testing analysis is conducted to compare the results of the tests to the six hypotheses defined, and decide whether there are supported, and whether new findings that were not hypothesized were discovered.

6.2 VARIABLE TYPES AND DESCRIPTIVE MEASURES

Defining a 10 years' time frame for data integration and sampling via EDGAR, the total number of Form 10-K publications (post-filtering) is 7618 individual Form 10-K reports. It should be noted that the combination of ticker and year is unique, since firms issue only one Form 10-K throughout the year (being annual), and in addition have only a single ticker representing them at the stock exchange. Hence, the 7618 reports are unique for both firm and year, and do not contain any repetitions (no two reports are made for a single year made by the same firm). The distribution of reports throughout the relevant years is presented in table 3, both in absolute values and in percentages from the overall corpus.

TABLE 3: CORPUS YEARLY DISTRIBUTION OF FORM 10-K REPORTS

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
N	471	586	607	634	618	795	868	981	949	1109	7618
%	6.18	7.69	7.97	8.32	8.11	10.44	11.39	12.88	12.46	14.56	100
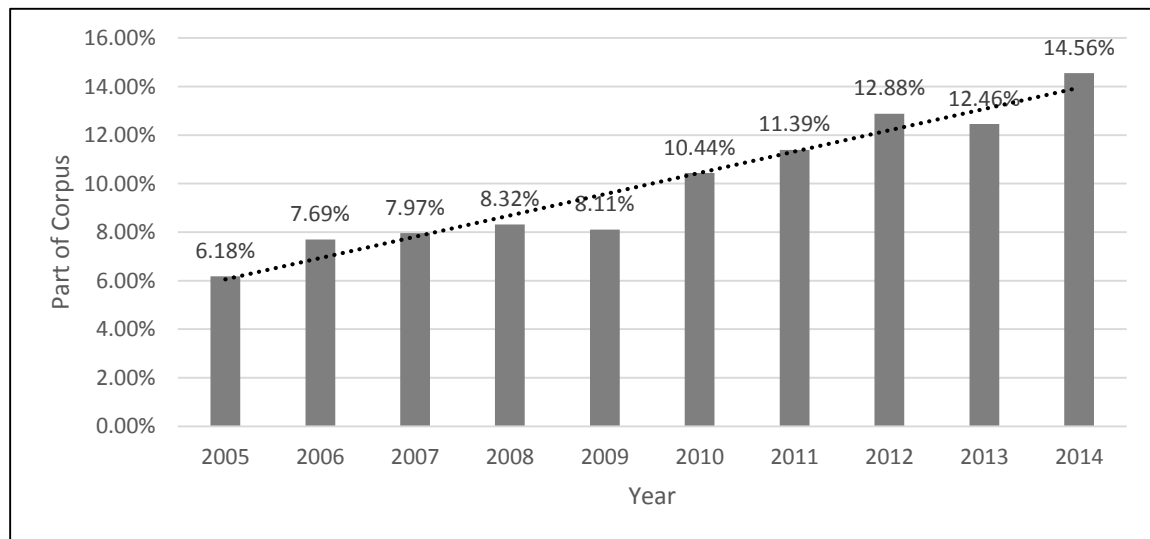
FIGURE 12: CORPUS YEARLY TREND OF FORM 10-K REPORTS

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As illustrated in figure 12 above, the number of reports has a positive growing trend, moving from 6.18% (471) Form 10-K reports published in 2005 to 14.56% (1109) on 2014[57].

Variables representing Form 10-K attributes

Attributes of Form 10-K publications are divided into two groups, intrinsic and external. These groups are each (respectively) divided to subgroups, readability and complexity, timing and relational.

The following table shows the respective variables for each group, and their description.

TABLE 4: FORM 10-K ATTRIBUTE VARIABLES BY GROUP AND TYPE

Group	Sub-Group	Variable	Type	Description
Intrinsic	Readability	FOG	Interval	Gunning-Fog readability index
		ARI	Interval	Automatic readability index
		FK	Interval	Flesch-Kincaid readability index
	Complexity	WC	Ratio	Word Count: number of words within the report
		NR	Ratio	Narrative Ratio: ratio between words and figures within the Form 10-K
External	Timing	PP	Ratio	Peak Proximity: number of days from closest publication peak (regulated at 60,75,90 days)
		DQ	Ratio	Days to quarter end: days left from the publication date to the first quarter end.
	Relational	B4	Boolean	Auditor tier: membership in "Big 4" (first-tier) auditors group (dichotomous)
		CN	Ratio	Concurrency: the overall number of publications which took place at the publication day.

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[57] This growth may be attributed to the growing extent of US economy in general, and the NASDAQ stock exchange listings in specific, all pointing to larger amount of trading firms. US Nominal GDP (in billions) grew from $13,093.7 in 2005 to $48,856 in 2015. In addition, US GDP per Capita grew from $17,348.1 in 2005 to $50,902 in 2015.The growth in trading firms is consistent with growth in US nominal GDP at the respective period, mounting to 373%, as differences in corpus reports between 2005 and 2015 is 236%. Retrieved from Bureau of Economic Analysis, Official United States GDP data online repository at www.bea.gov.

Variables FOG, ARI and FK show the readability score. As the value in this variable is higher (lower), the meaning is that the text is harder (easier) to read.

Variables WC and CN are direct measurements, indicating respectively the word count and report concurrency at the publication date. B4 variable is dichotomous, indicating first-tier membership.

Variables PP and DQ are relative in days and require attention: a large (small) PP value means larger (smaller) time span in days from the peak. This means that larger (smaller) PP values represent smaller (larger) peak proximity. The same situation applies to DQ variable: a large (small) DQ value means larger (smaller) time span in days from quarter 1 end. This means that larger (smaller) DQ values represent smaller (larger) quarter 1 end proximity.

Variables representing market trade attributes

As indicated at the methodology chapter, attributes of the market trade figures are divided into three groups:

The first group, measuring changes following a Form 10-K publication, for performance and adjusted performance (which will be referred to as "performance" for simplicity).

The second group, measuring the first group's impact relatively for the historical data for the specific stock, holds the following two variables: volume volatility, performance volatility.

Variables with RSD (Relative Standard Deviation) suffix represent volatility in respect to historical data, calculated by the coefficient of variance (see elaboration in 5.2.1 section). These variables have a direct positive connection, in which larger (smaller) RSD value represent the larger (smaller) difference from historical values.

The third group, measuring ranking changes, indicates the extent in which the ranking within a 28 days span (14 days prior and post-publication) is changed, holds the following two variables: delta inter-publication volume ranking (ΔV_RNK), delta inter-publication

performance ranking (ΔP_RNK). It should be noted that although these variables are ranking based, and therefore ordinal in nature, they are presented here as a ratio calculation between pre and post publication figures (see section 5.4.4 for elaboration), and therefore may be treated as a scale type rather than an ordinal one.

TABLE 5: TRADE RELATED VARIABLES BY GROUP

Group	Variable	Description
Volume Volatility	V3_RSD	Volume volatility measured in 3 days post-publication.
	V21_RSD	Volume volatility measured in 21 days post-publication.
Volume	V3	Aggregated volume measured in 3 days post-publication.
	V21	Aggregated volume measured in 21 days post-publication.
Performance	PA3	Aggregated performance measured in 3 days post-publication.
	PA21	Aggregated performance measured in 21 days post-publication.
Performance Volatility	PA3_RSD	Performance volatility measured in 3 days post-publication.
	PA21_RSD	Performance volatility measured in 21 days post-publication.
Pre/Post effect	ΔV_RNK	Delta inter-publication volume ranking
	ΔP_RNK	Delta inter-publication performance ranking

6.3 FORM 10-K ANNUAL TRENDS

This section includes a battery of tests for all Form 10-K attributes to examine the existence of a yearly trend. Further analysis and conclusions can be found at the hypothesis H2 test results section (6.9.2).

Trend detection for variable: FOG (Gunning Fog readability index)
Group: Form 10-K intrinsic attributes, Sub-group: Readability attributes.

A Jonckheere-Terpstra rank-based nonparametric test is conducted to detect the existence of a statistically significant trend between an ordinal independent year variable and the continuous dependent FOG variable, with hypotheses order smallest to largest.

The test results show that there is a statistically significant trend in Gunning Fog readability values, Jonckheere-Terpstra $F_{(10,7618)}=26.04$, $P<0.01$, indicating that Gunning Fog readability values of Form 10-K reports presented a significant positive growing course during the selected time-span. The trend is illustrated at the following figure:
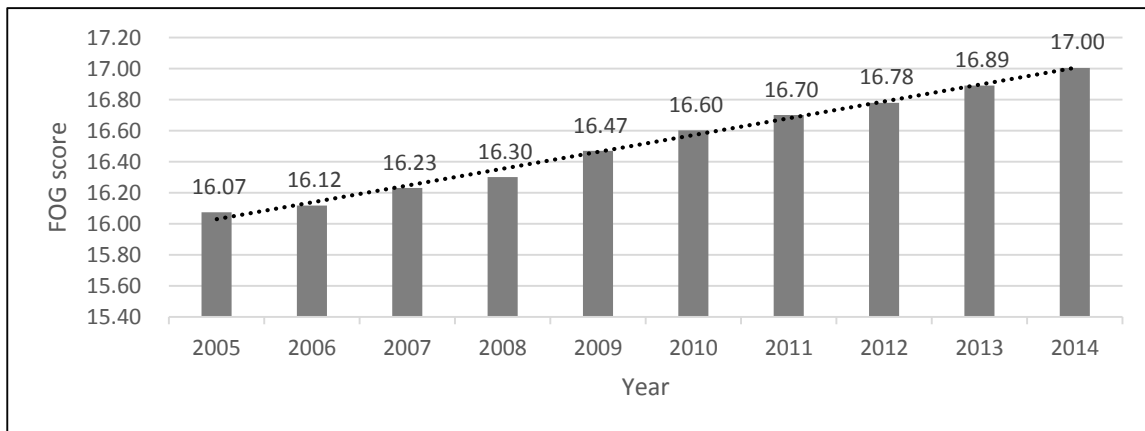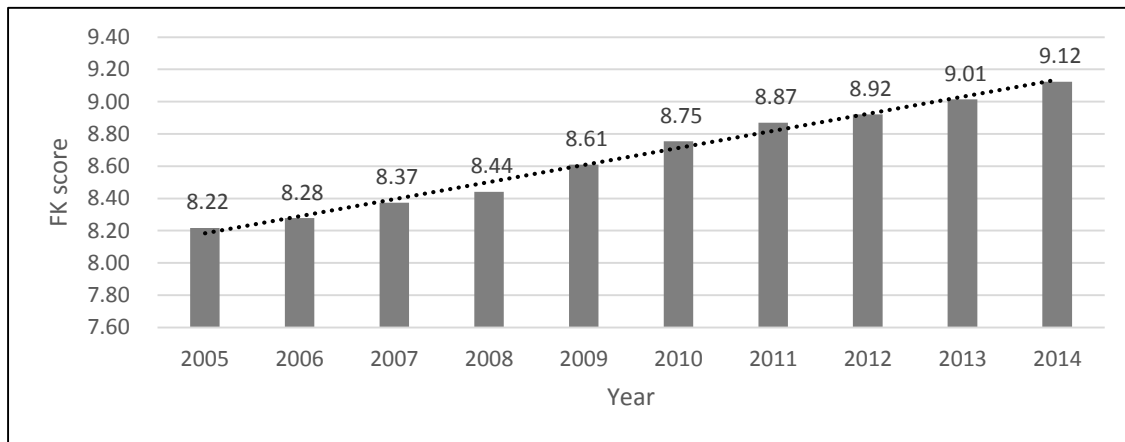

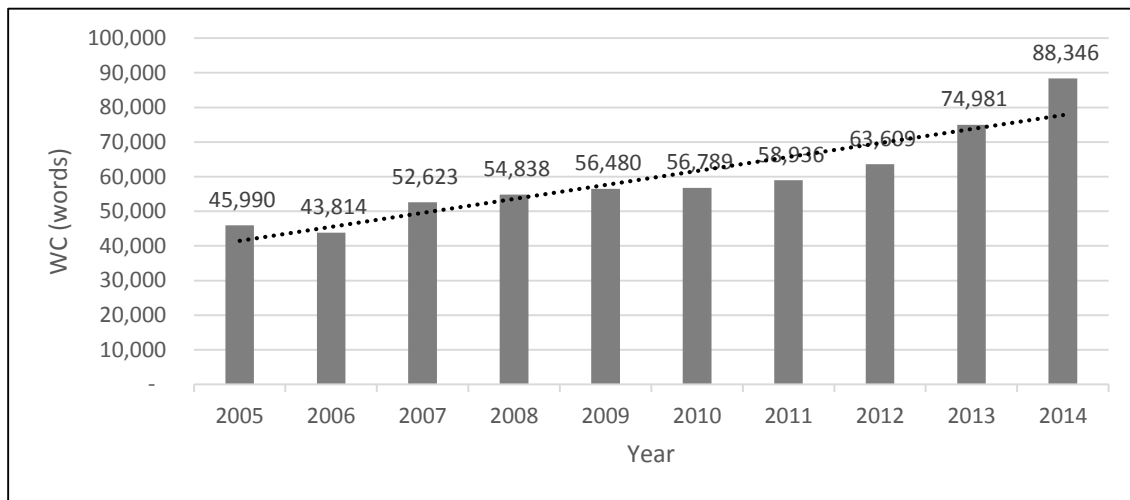FIGURE 13: FOG YEARLY TREND

TABLE 6: FOG ANNUAL MEANS

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mean	16.07	16.12	16.23	16.30	16.47	16.60	16.70	16.78	16.89	17.00

Trend detection for variable: ARI (Automatic Readability Index)

Group: Form 10-K intrinsic attributes, Sub-group: Readability attributes

A Jonckheere-Terpstra rank-based nonparametric test is conducted to detect the existence of a statistically significant trend between an ordinal independent year variable and the continuous dependent ARI variable, with hypotheses order smallest to largest.

The test results show that there is a statistically significant trend in Automatic Readability values, Jonckheere-Terpstra $F_{(10,7618)}=23.89$, $P<0.01$, indicating that Automatic Readability values of Form 10-K reports presented a significant positive growing course during the selected time-span.

The trend is illustrated at the following figure:
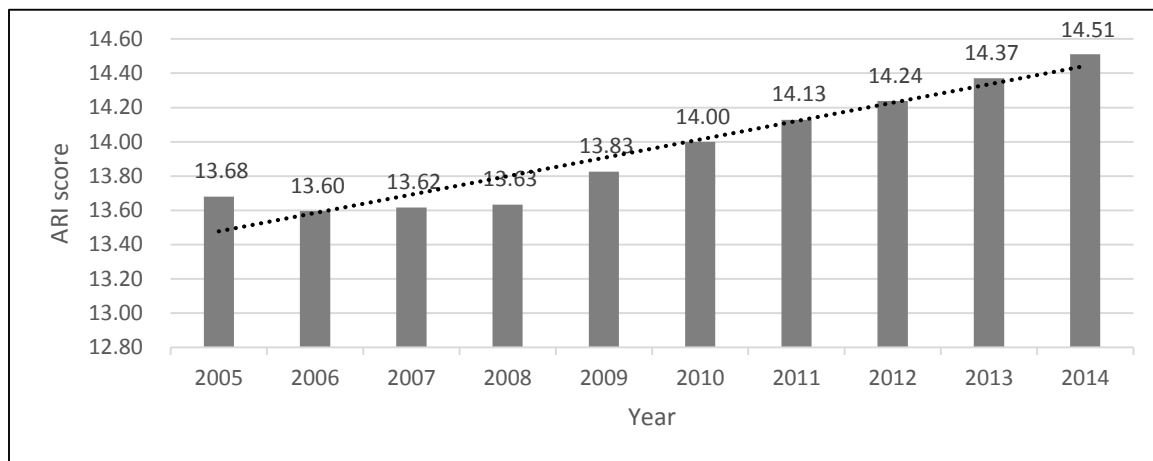
FIGURE 14: ARI YEARLY TREND

TABLE 7: ARI ANNUAL MEANS

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mean	13.68	13.60	13.62	13.64	13.83	14.00	14.13	14.24	14.37	14.51

Trend detection for variable: FK (Flesch-Kincaid Readability Index)

Group: Form 10-K intrinsic attributes, Sub-group: Readability attributes

A Jonckheere-Terpstra rank-based nonparametric test is conducted to detect the existence of a statistically significant trend between an ordinal independent year variable and the continuous dependent FK variable, with hypotheses order smallest to largest.

The test results show that there is a statistically significant trend in Flesch-Kincaid Readability values, Jonckheere-Terpstra $F(10,7618)=26.92$, $P<0.01$, indicating that Flesch-Kincaid Readability values of Form 10-K reports presented a significant positive growing course during the selected time-span.

The trend is illustrated at the following figure:

FIGURE 15: FK YEARLY TREND

TABLE 8: FK ANNUAL MEANS

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mean	8.22	8.28	8.38	8.44	8.61	8.76	8.87	8.92	9.01	9.12

Trend detection for variable: WC (Word Count)

Group: Form 10-K intrinsic attributes, Sub-group: Complexity attributes

A Jonckheere-Terpstra rank-based nonparametric test is conducted to detect the existence of a statistically significant trend between an ordinal independent year variable and the continuous dependent Word Count variable, with hypotheses order smallest to largest.

The test results show that there is a statistically significant trend in Word Count values, Jonckheere-Terpstra $F_{(10,7618)}=33.53$, $P<0.01$, indicating that Word Count values of Form 10-K reports presented a significant positive growing course during the selected time-span.

The yearly trend is illustrated at the following figure:

FIGURE 16: WORD COUNT YEARLY TREND

TABLE 9: WORD COUNT ANNUAL MEANS (THOUSANDS)

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Avg.	45.99	43.81	52.62	54.84	56.48	56.79	58.94	63.61	74.98	88.35

Trend detection for variable: NR (Narrative Ratio)

Group: Form 10-K intrinsic attributes, Sub-group: Complexity attributes

A Jonckheere-Terpstra rank-based nonparametric test is conducted to detect the existence of a statistically significant trend between an ordinal independent year variable and the continuous dependent Narrative Ratio variable, with hypotheses order smallest to largest.

The test results show that there is a statistically significant trend in Narrative Ratio values, Jonckheere-Terpstra $F_{(10,7618)}=15.87$, $P<0.01$, indicating that Narrative Ratio values of Form 10-K reports presented a significant positive growing course during the selected time-span.

The trend is illustrated at the following figure:
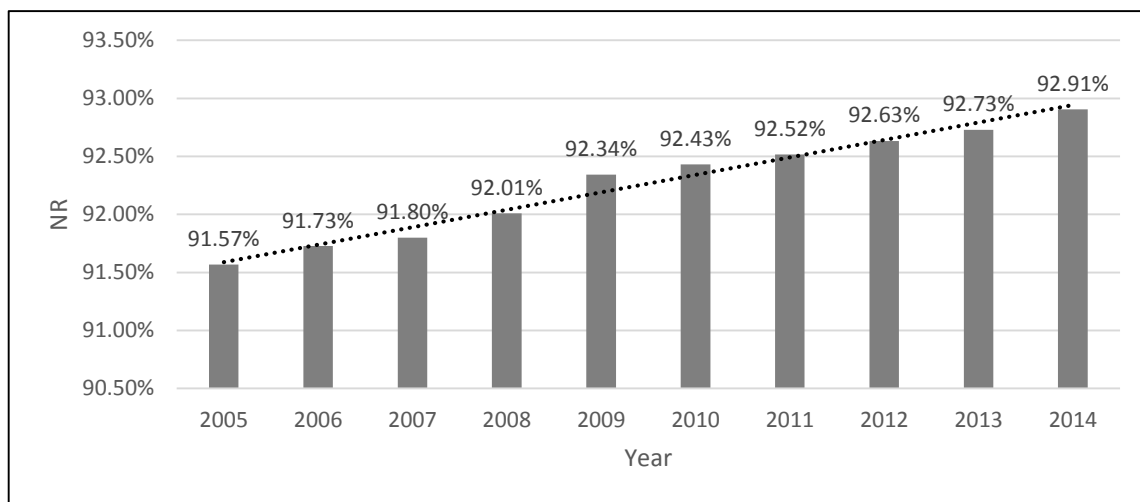
FIGURE 17: NARRATIVE RATIO YEARLY TREND

TABLE 10: NARRATIVE RATIO ANNUAL MEANS

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Avg.	91.57	91.73	91.80	92.01	92.34	92.43	92.52	92.63	92.73	92.91

Trend detection for variable: PP (Peak Proximity)

Group: Form 10-K External attributes, Sub-group: Timing attributes

A Jonckheere-Terpstra rank-based nonparametric test is conducted to detect the existence of a statistically significant trend between an ordinal independent year variable and the continuous dependent Peak Proximity variable, with hypotheses order smallest to largest.

The test results show that there is a statistically significant trend in Peak Proximity values, Jonckheere-Terpstra $F_{(10,7618)}=19.21$, $P<0.01$, indicating that Peak Proximity values of Form 10-K reports presented a significant positive growing course during the selected time-span.

The yearly trend is illustrated at the following figure:
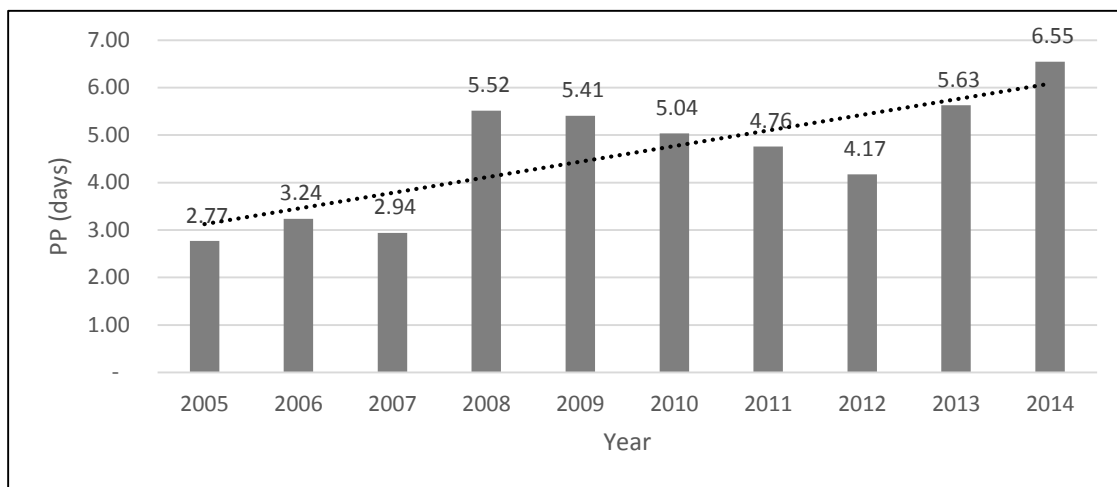
FIGURE 18: PEAK PROXIMITY YEARLY TREND

TABLE 11: PEAK PROXIMITY ANNUAL MEANS

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Avg.	2.77	3.24	2.94	5.52	5.41	5.04	4.76	4.17	5.63	6.55

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Trend detection for variable: DQ (Days to quarter 1 end)

Group: Form 10-K External attributes, Sub-group: Timing attributes

A Jonckheere-Terpstra rank-based nonparametric test is conducted to detect the existence of a statistically significant trend between an ordinal independent year variable and the continuous dependent DQ variable, with hypotheses order smallest to largest.

The test results show that there is a statistically significant trend in Days to quarter 1 end values, Jonckheere-Terpstra $F_{(10,7618)}=15.95$, $P<0.01$, indicating that Days to quarter 1 end values of Form 10-K reports presented a significant positive growing course during the selected time-span.

The trend is illustrated at the following figure:
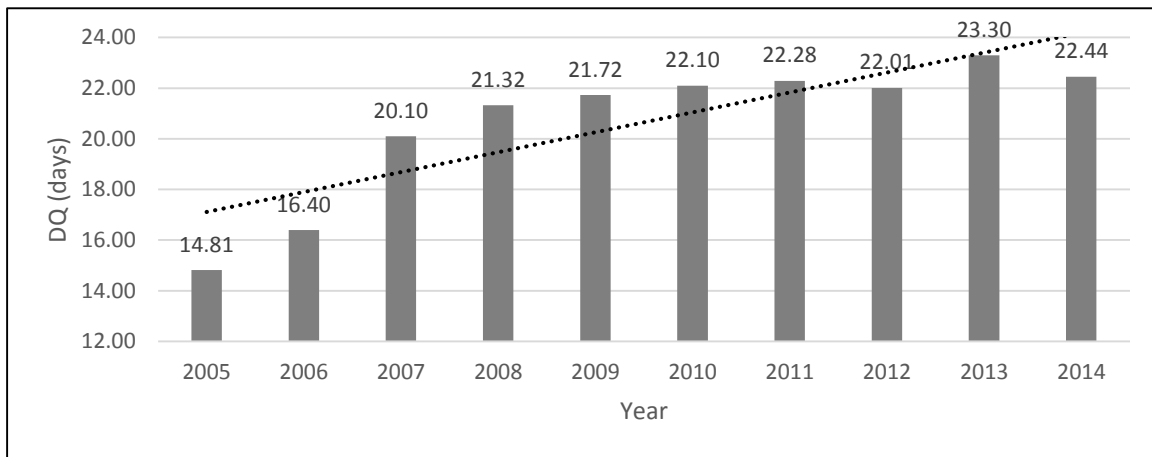
FIGURE 19: DAYS TO QUARTER 1 END YEARLY TREND

TABLE 12: DAYS TO QUARTER 1 END ANNUAL MEANS

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Avg.	14.81	16.40	20.10	21.32	21.72	22.10	22.28	22.01	23.30	22.44

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Trend detection for variable: Variable: CN (Concurrency)

Group: Form 10-K External attributes, Sub-group: Relational attributes

A Jonckheere-Terpstra rank-based nonparametric test is conducted to detect the existence of a statistically significant trend between an ordinal independent year variable and the continuous dependent Concurrency variable, with hypotheses order largest to smallest.

The test results show that there isn't a statistically significant trend in Concurrency values, Jonckheere-Terpstra $F_{(10,7618)}=-0.02$, $P=0.984$, indicating that Concurrency values of Form 10-K reports do not have a significant positive or negative course during the selected time-span.
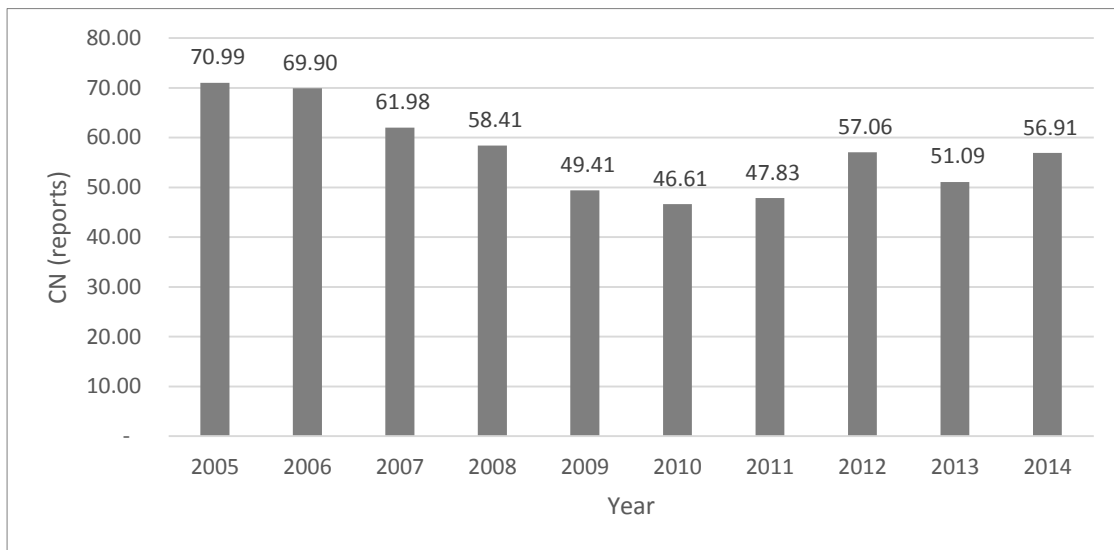
FIGURE 20: CONCURRENCY YEARLY TREND

TABLE 13: CONCURRENCY ANNUAL MEANS

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Avg.	70.99	69.90	61.98	58.41	49.41	46.61	47.83	57.06	51.09	56.91

6.4 AUDIT-TIER IMPACT ON FORM 10-K ATTRIBUTES

The distribution of auditors within the Form 10-K reports published at the selected time-span, segmented by first-tier members is illustrated in table 14. The dominance of the first-tier auditors is distinct, as the first-tier members have in aggregate more than half the share of filings in this corpus. As indicated, the combined share of all other (non-first-tier) auditors, measure 43% from the corpus (3236 transmissions).

TABLE 14: YEARLY FORM 10-K REPORTS IN CORPUS BY FIRST-TIER AUDITOR

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
N	300	368	375	370	330	433	485	557	549	625
%	63.56	62.69	60.88	58.18	53.05	54.13	55.62	56.72	57.67	56.05

In each of the 10 years examined over half of the publications contained a Form 10-K which was audited by a member of the "Big 4" group. However, as the number of publications grows, the percentage is showing a lesser portion from the entire corpus, going down from 63.56% in 2005 to 56.05% in 2014 (see table 14).

This trend is also illustrated in figure 21. First-tier membership rate is changing throughout the years: as seen on Figure 21, a declining tendency mounting to 10% reduction (62.69% to 53.05%) is stopped at 2009, and is replaced with a mild incline tendency (53.05% to 57.67%), lasting until 2014. Effects related to years 2008-9 (financial crisis) are discussed in elaboration in section 12.1 at the appendix.

Auditor switching firms: Looking into firms loyalty toward auditors, the results show that out of 1345 firms at the 10 years corpus, 77.4% (1041 firms) stayed throughout all of the ten years examined with the same audit tier, while the other 22.6% (304 firms)[58] had at

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[58] See figure 50 at the Appendix.

least one auditor from each tier within said time span. Out of the total 1345 firms, 66.47% (894 firms) were audited by a first-tier auditor at least once (within the set 10 years), and only 33.53% (451 firms)[59] were only audited by a non-first-tier auditor.

In accordance, out of the total 1345 firms, 56.13% (755 firms)[60] were audited by a non-first-tier auditor at least once (within the set 10 years), and only 43.87% (590 firms) were only audited by a first-tier auditor. When examining the loyalty of firms to auditors among the first-tier auditors (excluding non-first-tier auditors), a significant 93.51% (836 firms out of 894 firms)[61] did not change between two or more first-tier auditors at all at the ten years examined.

Only 57 firms (6.38%) were audited at least once by two separate first-tier auditors, and only one firm[62] was audited by three first-tier auditors. This suggests that while changing auditor tier is not common (22.5%), changing auditors within the first-tier is even scarcer (6.49%). Section 12.2 at the appendix contain descriptive statistics, histogram and box-plots for each of the variables mentioned.

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[59] See figure 51 at the Appendix.

[60] See figure 52 at the Appendix.

[61] See figure 53 at the Appendix.

[62] Morningstar, Inc. ,an investment research and investment management firm headquartered in Chicago, Illinois, having KPMG replace Ernst & Young at 2011, and having also been audited by Deloitte in 2006.
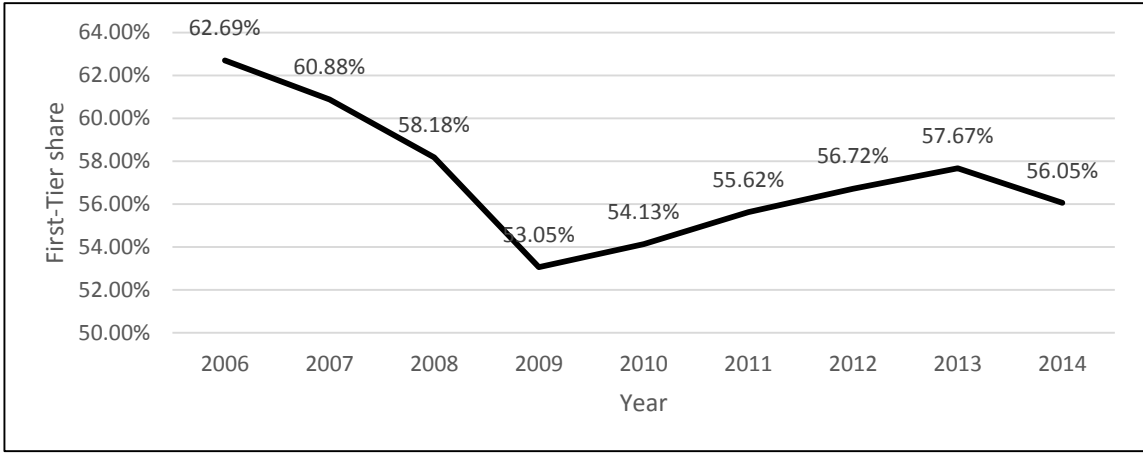
FIGURE 21: YEARLY RATE OF FIRST-TIER AUDIT DISTRIBUTION

The following section includes a battery of tests for all Form 10-K attributes to examine the existence of a significant difference between audit-tiers. Further analysis and conclusions can be found at the testing results section, in section 6.9.1.

Audit-tier influence detection for variable: FOG (Gunning Fog readability index)

In accordance of the normal distribution of the FOG variable (illustrated in figure 34), an independent-samples T-Test was conducted to compare FOG in B4 groups (first-tier and non-first-tier auditors). The homogeneity of variance as assessed by Levene's Test for Equality of Variances was rejected with p<0.05, so T-Test results were performed for equal variances not assumed.

The test results show that there isn't a statistically significant difference in Gunning Fog Readability values between Form 10-K reports audited by a first-tier auditor (*M*=16.58, *SD*=1.1) and Form 10-K reports audited by a non-first-tier auditor (*M*=16.6, *SD*=1.04). Values of Gunning Fog Readability are not significantly higher or lower within Form 10-K reports audited by a first-tier auditor, t(7161.02)=-0.61, p=0.53.

FOG values between the B4 groups are illustrated at the next figure, showing mixed values of higher FOG among the two groups:
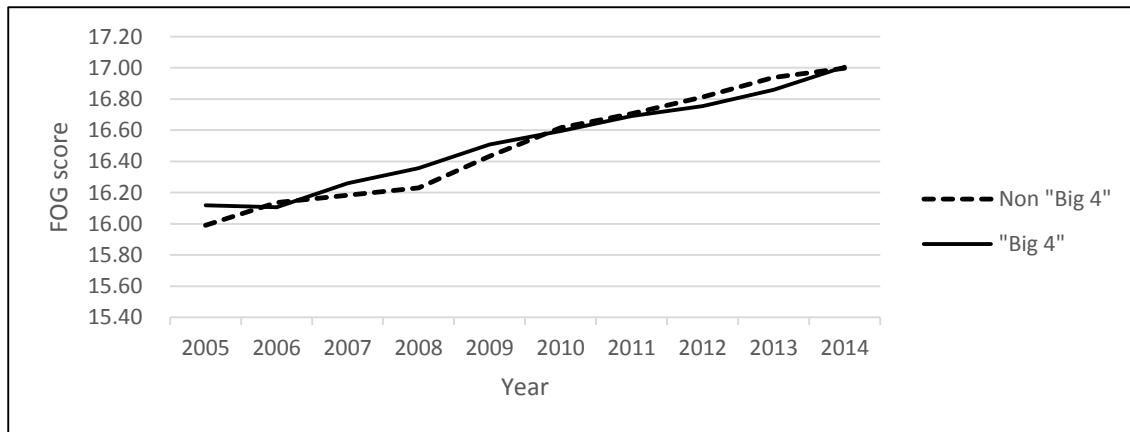
FIGURE 22: FOG ANNUAL MEANS BY AUDITOR GROUP

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Audit-tier influence detection for variable: ARI (Automatic Readability Index)

In accordance of the normal distribution of the ARI variable (illustrated in figure 35), an independent-samples T-Test was conducted to compare ARI in B4 groups (first-tier and non-first-tier auditors). The homogeneity of variance as assessed by Levene's Test for Equality of Variances was rejected with $p<0.01$, so T-Test results were performed for equal variances not assumed.

The test results show that there is a statistically significant difference in Automatic Readability values between Form 10-K reports audited by a first-tier auditor $(M=14.11, SD=1.27)$ and Form 10-K reports audited by a non-first-tier auditor $(M=13.94, SD=1.15)$. Values of Automatic Readability are higher within Form 10-K reports audited by a first-tier auditor, $t(7296.18)=5.84$, $p<0.01$.

This indication is illustrated at the following figure:
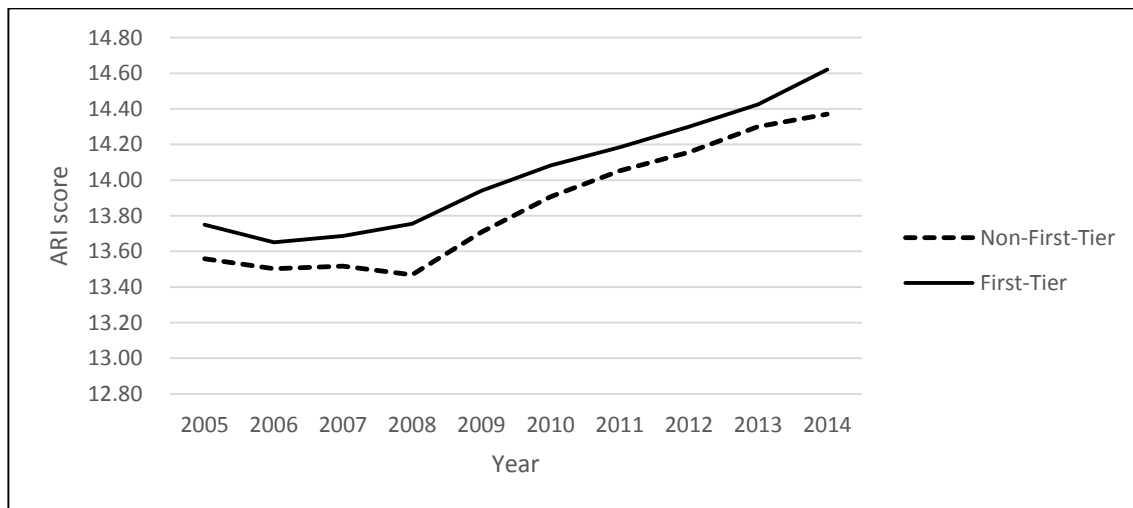
FIGURE 23: ARI ANNUAL MEANS BY AUDITOR GROUP

Audit-tier influence detection for variable: FK (Flesch-Kincaid Readability Index)

In accordance of the normal distribution of the FK variable (illustrated in figure 37), an independent-samples T-Test was conducted to compare FK in B4 groups. The homogeneity of variance as assessed by Levene's Test for Equality of Variances was rejected with p<0.01, so T-Test results were performed for equal variances not assumed.

The test results show that there is a statistically significant difference in Flesch-Kincaid Readability values between Form 10-K reports audited by a first-tier auditor (M=8.77, SD=1.03) and Form 10-K reports audited by a non-first-tier auditor (M=8.68, SD=0.93). Values of Flesch-Kincaid Readability are higher within Form 10-K reports audited by a first-tier auditor, t(7296.18)=3.85, p<0.01.

This indication is illustrated at the following figure:
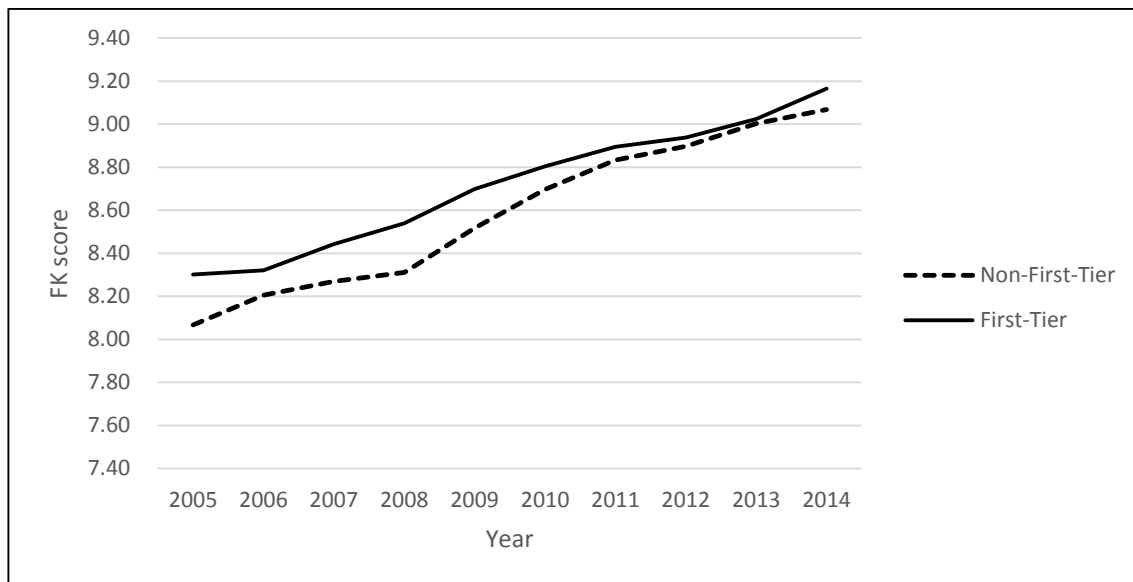
FIGURE 24: FK ANNUAL MEANS BY AUDITOR GROUP

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Audit-tier influence detection for variable: WC (Word Count)

In accordance of the non-normal distribution of the Word Count variable (illustrated in figure 39), an independent samples Mann-Whitney non-parametric test is conducted to compare Word Count in B4 groups (first-tier and non-first-tier auditors).

The test results show that there is a statistically significant difference in Word Count values between Form 10-K reports audited by a first-tier auditor (N=4382, Mean rank=4207.41) and Form 10-K reports audited by a non-first-tier auditor (N=3236, Mean rank=3270.68). Values of Word Count are higher within Form 10-K reports audited by a first-tier auditor, $z=18.37$, $p<0.01$.

This indication is illustrated at the following figure:
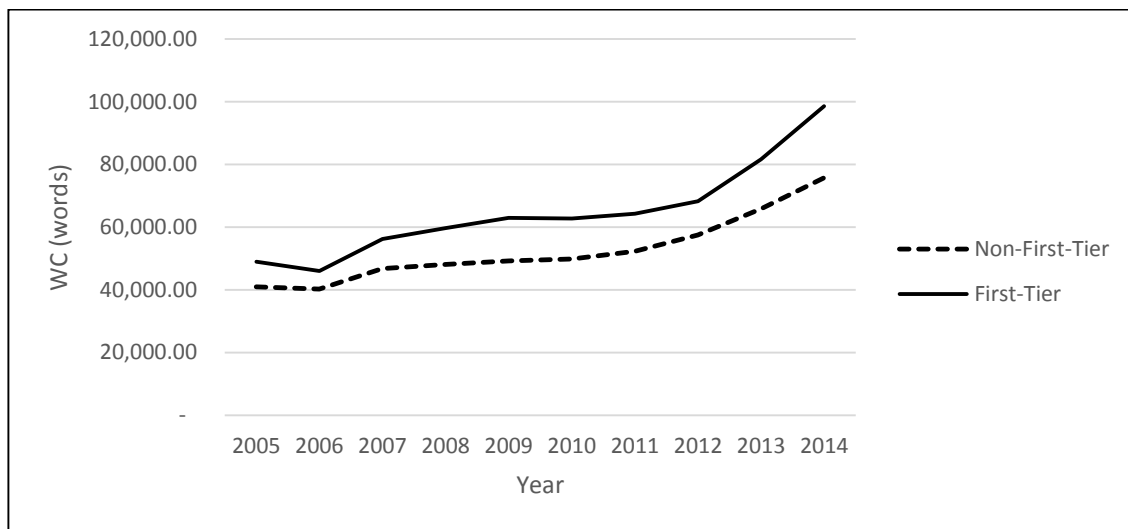
FIGURE 25: WORD COUNT ANNUAL MEANS BY AUDITOR GROUP

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Audit-tier influence detection for variable: NR (Narrative Ratio)

In accordance of the non-normal distribution of the Narrative Ratio variable (illustrated in figure 41), an independent samples Mann-Whitney nonparametric test is conducted to compare Narrative Ratio in B4 groups.

The test results show that there is a statistically significant difference in Narrative Ratio values between Form 10-K reports audited by a first-tier auditor (N=4382, Mean rank=4257.88) and Form 10-K reports audited by a non-first-tier auditor (N=3236, Mean rank=3202.33). Values of Narrative Ratio are higher within Form 10-K reports audited by a first-tier auditor, z=20.70, p<0.01.

This indication is illustrated at the following figure:
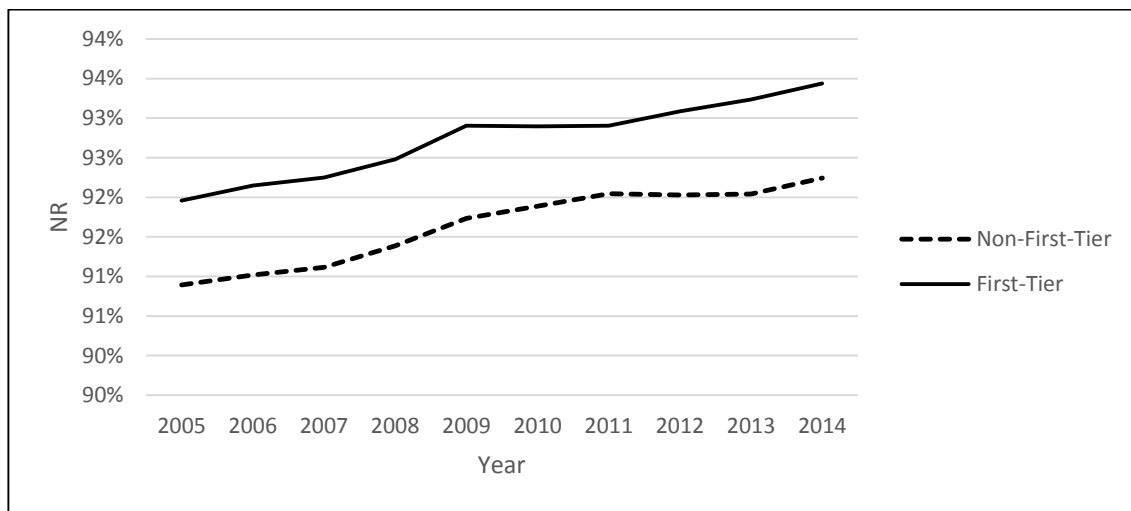
FIGURE 26: NARRATIVE RATIO ANNUAL MEANS BY AUDITOR GROUP

Audit-tier influence detection for variable: PP (Peak Proximity)

In accordance of the non-normal distribution of the Peak Proximity variable (illustrated in figure 41), an independent samples Mann-Whitney non-parametric test is conducted to compare Peak Proximity in B4 groups (first-tier and non-first-tier auditors).

The test results show that there is a statistically significant difference in Peak Proximity values between Form 10-K reports audited by a first-tier auditor (N=4382, Mean rank=3869.48) and Form 10-K reports audited by a non-first-tier auditor (N=3236, Mean rank=3728.27). Values of Peak Proximity are higher within Form 10-K reports audited by a first-tier auditor, z=2.79, p<0.01.

This indication is illustrated at the following figure:
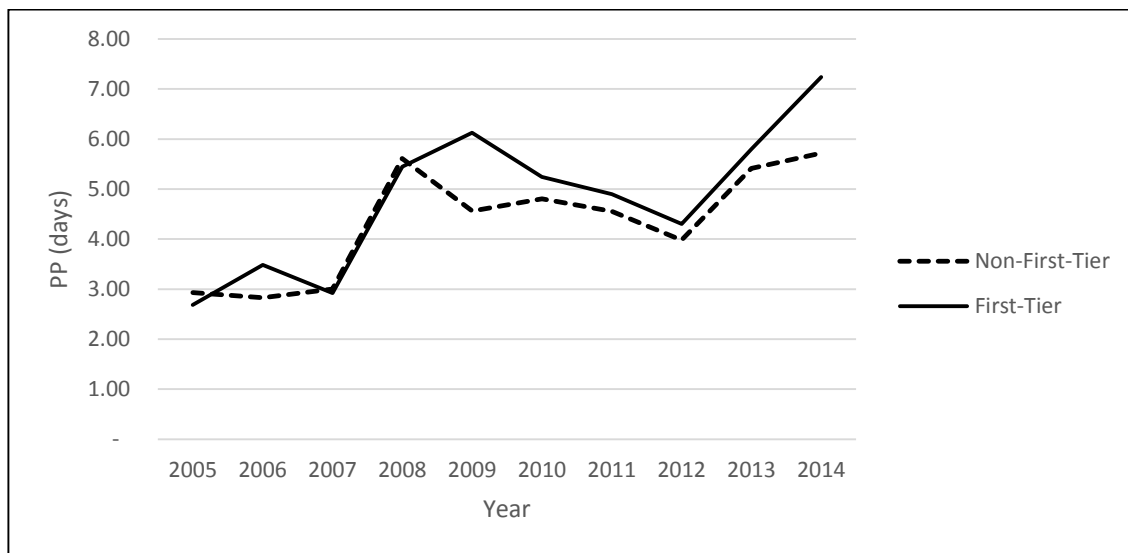
FIGURE 27: PEAK PROXIMITY ANNUAL MEANS BY AUDITOR GROUP

Audit-tier influence detection for variable: DQ (Days to quarter 1 end)

In accordance of the non-normal distribution of the Days to quarter 1 end variable (illustrated in figure 45), an independent samples Mann-Whitney non-parametric test is conducted to compare Days to quarter 1 in B4 groups.

The test results show that there is a statistically significant difference in Days to quarter 1 end values between Form 10-K reports audited by a first-tier auditor (N=4382, Mean rank=3312.71) and Form 10-K reports audited by a non-first-tier auditor (N=3236, Mean rank=4482.23). Values of Days to quarter 1 end are higher within Form 10-K reports audited by a first-tier auditor, z=24.03, p<0.01.

This indication is illustrated at the following figure:
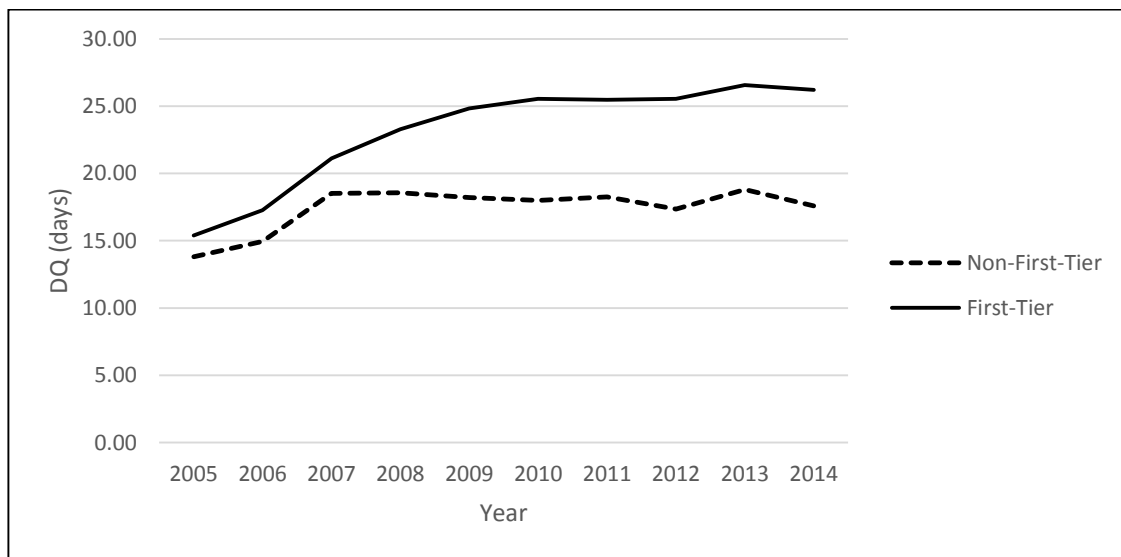
FIGURE 28: DAYS TO QUARTER 1 END ANNUAL MEANS BY AUDITOR GROUP

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Audit-tier influence detection for variable: CN (Concurrency)

In accordance of the non-normal distribution of the Concurrency variable (illustrated in figure 47), an independent samples Mann-Whitney non-parametric test is conducted to compare Concurrency in B4 groups (first-tier and non-first-tier auditors).

The test results show that there is a statistically significant difference in Concurrency values between Form 10-K reports audited by a first-tier auditor (N=4382, Mean rank=3856.39) and Form 10-K reports audited by a non-first-tier auditor (N=3236, Mean rank=3746,01). Values of Concurrency are higher within Form 10-K reports audited by a first-tier auditor, z=2.16, p<0.05

This indication is illustrated at the following figure:
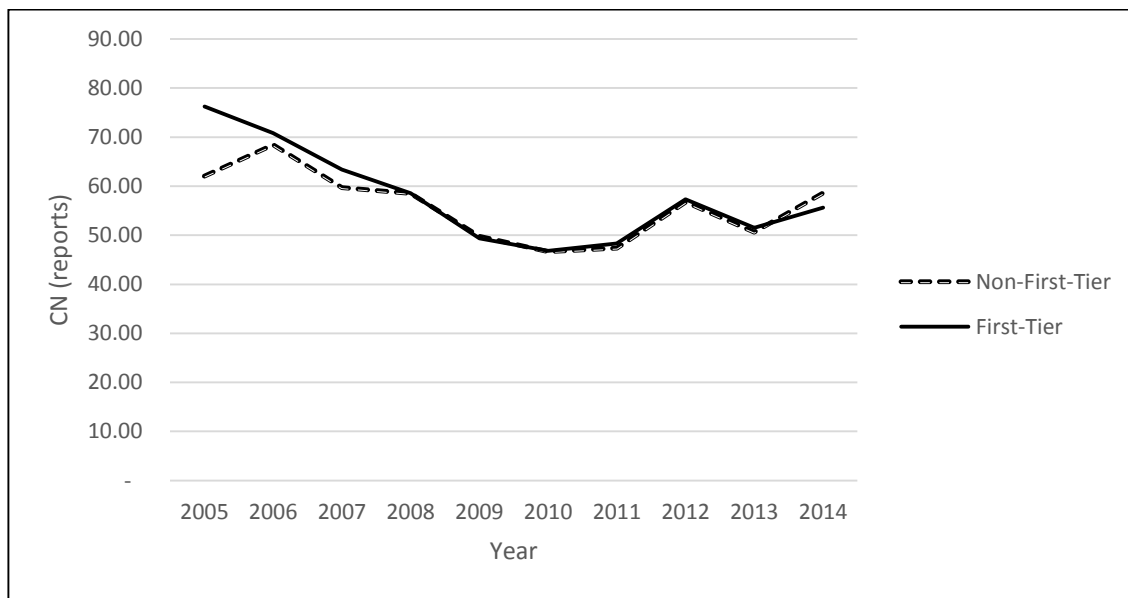
FIGURE 29: CONCURRENCY ANNUAL MEANS BY AUDITOR GROUP

6.5 FORM 10-K ATTRIBUTES CORRELATION ANALYSIS

Testing readability variables correlations, the results are as follows:

TABLE 15: PEARSON SIGNIFICANT CORRELATIONS FOR READABILITY VARIABLES

Comparison	All	Non-First-Tier	First-Tier
FOG and ARI	0.935 **	0.928 **	0.943 **
FOG and FK	0.962 **	0.954 **	0.963 **
ARI and FK	0.950 **	0.951 **	0.956 **
** p<0.01			

The results indicate readability variables have high correlation among themselves. The readability indices are influenced by different measures of text: FOG is estimating complex words by syllable limit count, ARI is estimating complex words by characters count, and FK is estimating complex words by syllable relative count. Since multi-syllable words correlate with a large number of characters (as a structure of the English language), all three indices are inherently led to present similar correlation among themselves.

Narrative Ratio variable correlation with readability indices show the following results:

TABLE 16: PEARSON SIGNIFICANT CORRELATIONS FOR NARRATIVE RATIO

Comparison	All	Non-First-Tier	First-Tier
Narrative Ratio and FOG	0.401 **	0.341 **	0.455 **
Narrative Ratio and ARI	0.456 **	0.393 **	0.486 **
Narrative Ratio and FK	0.498 **	0.442 **	0.537 **
** p<0.01			

Test results show Pearson correlations for Narrative ratio: FOG $r(7616)=0.401$, ARI $r(7616)=0.456$, FK $r(7616)=0.498$ with First-tier correlations of FOG $r(4380)=0.455$, ARI

r(4380)=0.486, FK r(4380)=0.537 and non-first-tier correlations of FOG r(3234)=0.341, ARI r(3234)=0.393, FK r(3234)=0.442.

This indicates that Form 10-K reports readability indices correlate in a medium strength to the Narrative Ratio. Put simply, firms issuing Form 10-K reports which are more narrative in nature (contain fewer charts and figures) also tend to write texts which are harder to read. As illustrated on table 16, this correlation is stronger among the first-tier group, showing larger correlations in approximately 9%.

Testing the Word Count variable correlation with readability indices show the following results:

TABLE 17: PEARSON SIGNIFICANT CORRELATIONS FOR WORD COUNT

Comparison	All	Non-First-Tier	First-Tier
Word Count and FOG	0.125 **	0.084 **	0.157 **
Word Count and ARI	0.135 **	0.091 **	0.146 **
Word Count and FK	0.151 **	0.125 **	0.158 **
** P<0.01			

Test results show Pearson correlations for Word Count: FOG r(7616)=0.125, ARI r(7616)=0.135, FK r(7616)=0.498 with First-tier correlations of FOG r(4380)=0.157, ARI r(4380)=0.146, FK r(4380)=0.158 and non-first-tier correlations of FOG r(3234)=0.084, ARI r(3234)=0.091, FK r(3234)=0.125.

These results further indicate the differences in correlations within audit-tiers. Although significant, all correlations found (illustrated in table 17) are weak (r=~0.15), nevertheless difference in magnitude between tiers is considerable, especially in FOG variable (0.084 versus 0.157).

The conclusion deriving from both Narrative ratio and Word Count correlations (with readability indices) indicates that longer Form 10-K reports and Form 10-K reports with high narrative ratio are likely to be hard to read (measured by all three indices), and that

theses correlations are stronger (~9% over narrative ratio, ~21% to ~47% over word count) among the first-tier audited Form 10-K reports.

Testing Concurrency and Timing attributes correlations, the results are as follows:

Comparison	All	Non-First-Tier	First-Tier
Concurrency and Peak Proximity	-0.635 **	-0.607 **	-0.658 **
Concurrency and Days to quarter 1 end	-0.206 **	-0.084 **	-0.320 **
**P<0.01			

Test results show Pearson correlations for Concurrency PP $r(7616)=-0.635$ with First-tier correlations of PP $r(4380)=-0.658$ and non-first-tier correlations of PP $r(3234)=-0.607$

Test results show Pearson correlations for Concurrency DQ $r(7616)=-0.206$ with First-tier correlations of DQ $r(4380)=-0.320$ and non-first-tier correlations of DQ $r(3234)=-0.084$.

These results may be interpreted in several aspects: first of all, peak proximity is negatively correlated with concurrency – meaning that as getting close to the deadline (peak proximity is lower, measured in days from peak), the concurrency of published reports is growing. This is an outcome of the mentioned phenomenon in which firms favor publishing Form 10-K reports close to the deadline, and is relevant for both first-tier and non-first-tier auditor groups, with a slightly stronger (-0.658 versus -0.607) negative connection at the first-tier group.

As indicated, a distinct difference between Concurrency and Days to quarter 1 end correlation is detected among first-tier and non-first-tier auditors group. This correlation exists only among the first-tier auditors, and isn't observed among the non-first-tier auditors. This phenomenon is discussed in the next chapter, and is a derivative of SEC regulation among small and medium firms which have a larger concentration of non-first-

tier auditors, and deliver Form 10-K reports during the 75 and 90 days deadlines (hence have two concurrency peaks which in turn mitigate the said correlation).

Testing Concurrency and Timing attributes correlations, the results are as follows:

TABLE 19: PEARSON SIGNIFICANT CORRELATIONS FOR INTRINSIC ATTRIBUTES

Comparison	All	Non-First-Tier	First-Tier
Peak Proximity and FOG	0.042 **	0.078 **	0.020 **
Peak Proximity and ARI	0.044 **	0.077 **	0.019 **
Peak Proximity and FK	0.055 **	0.094 **	0.029 **
Peak Proximity and WC	0.073 **	0.047 **	0.079 **
**P<0.01			

Peak Proximity results show Pearson correlations for readability as follow: FOG $r(7616)=0.042$, ARI $r(7616)=0.044$, FK $r(7616)=0.055$ with First-tier correlations of FOG $r(4380)=0.020$, ARI $r(4380)=0.019$, FK $r(4380)=0.029$ and non-first-tier correlations of FOG $r(3234)=0.078$, ARI $r(3234)=0.077$, FK $r(3234)=0.047$, and for word count,: WC $r(7616)=0.073$ with First-tier correlations of WC $r(4380)=0.047$ and non-first-tier correlations of WC $r(3234)=0.079$.

Although statistically significant, since all figures are small ($r<0.1$) it may be concluded that Peak Proximity correlation with readability indices and Word Count is not present.

6.6 FORM 10-K ATTRIBUTES IMPACT ON PERFORMANCE

6.6.1   Form 10-K external attributes impact on performance

In order to establish the relationship of external attributes with short and long-term performance, the following battery of tests is taken:

- **T1:** A one-way between subjects ANOVA is conducted to compare the effect of external attributes cluster (C_EXT) on performance within three days post-publication (PA3). Results indicate that there is a significant effect of external Form 10-K attributes on short-term performance $F(3,7612)=56.73$, $p<0.01$.

- **T2:** A post hoc Tukey test show that cluster 1 ($M=8.07$,$SD=27.09$) differed significantly with a level of $P<0.01$ from cluster 2 ($M=2.74$,$SD=16.67$) and from cluster 3 ($M=0.02$,$SD=4.51$) and from cluster 4 ($M=-0.22$,$SD=4.19$), and that that cluster 2 ($M=2.74$,$SD=16.67$) differed significantly with a level of $P<0.01$ from cluster 4 ($M=-0.22$,$SD=4.19$). However, cluster 3 ($M=0.02$,$SD=4.51$) does not differ significantly ($P=0.932$) from cluster 4 ($M=-0.22$,$SD=4.19$). This suggests that the significant difference in external attributes values for performance within three days post-publication (PA3) is caused due to differences among all clusters, excluding clusters 3 and 4 whose values do not present significant difference, meaning that the significance is not caused by a single cluster.

- **T3:** A multiple linear regression is calculated to predict dependent variable PA3 (3 days performance) based on external attributes of Form 10-K (Timing and Relations groups): Days to quarter 1 end (DQ), Peak proximity (PP), Concurrency (CN), Audit-tier (B4). A significant equation is found $F(5,7605)=42.68$, $p<0.01$ with an adjusted R^2 of 0.027. External attributes variables (DQ, PP, CN) proved significant predictors of short-term performance (PA3), with $p<0.01$, while audit-tier variable (B4) proved insignificant as a predictor. For β values analysis, see section 6.8.

- **T4:** A one-way between subjects ANOVA is conducted to compare the effect of external attributes cluster (C_EXT) on performance within 21 days post-publication

(PA21). Results indicate that there isn't a significant effect of external Form 10-K attributes on short-term performance $F(3,7612)=0.328$, $p=0.805$.

- **T5:** A multiple linear regression is calculated to predict dependent variable PA21 (21 days performance) based on external attributes of Form 10-K (Timing and Relations groups): Days to quarter 1 end (DQ), Peak proximity (PP), Concurrency (CN), Audit-tier (B4). An insignificant equation was found $F(5,7605)=1.17$, $p=0.312$, indicating that external attributes variables (DQ, PP, CN, B4) are not significant predictors of long-term performance (PA21).

The results indicate that external attributes, as manifested in external attribute cluster (C_EXT) have a significant impact short-term performance, both from mean values perspective (T1 results), and as predictors (T3 results). Said results are not caused by a single cluster (T2 results). This impact isn't significantly observed at the long-term, either from mean values perspective (T4 results) and as predictors (T5 results).

Results are demonstrated in table 20.

TABLE 20: RESULTS SUMMARY - EXTERNAL ATTRIBUTES IMPACT ON PERFORMANCE

Form 10-K Attributes Cluster	Short-Term	Long-term
ANOVA	**T1:** Short-term performance (PA3) $F(3,7612)=56.73$ **	**T4:** Long-term performance (PA21) $F(3,7612)=0.328$, $p=0.805$ Not-Significant
POST-HOC TUKEY	**T2:** Short-term performance (PA3) Clusters pairs (1-2,1-3,1-4,2-4) ** Clusters pair (3-4) P=0.932 (Not-Significant)	Not applicable due to non-significant ANOVA results
LINEAR REGRESSION	**T3:** Short-term performance (PA3) $F(5,7605)=42.68$ ** β: B4 insignificant, DQ positive, PP-positive, CN negative	**T5:** Long-term performance (PA21) $F(5,7605)=1.17$, $p=0.312$ Not-Significant
** p<0.01		

6.6.2 Form 10-K intrinsic attributes impact on performance

In order to establish the relationship of intrinsic attributes with short and long-term performance, the following battery of tests is taken:

- **T6:** A one-way between subjects ANOVA is conducted to compare the effect of intrinsic attributes cluster (C_INT) on performance within 3 days post-publication (PA3). Results indicate that there isn't a significant effect of external Form 10-K attributes on short-term performance $F(3,7612)=1.651$, $p=0.175$.

- **T7:** A multiple linear regression is calculated to predict dependent variable PA3 (3 days performance) based on intrinsic attributes of Form 10-K (Readability and Complexity groups): all readability indices (FOG, ARI, FK), Word Count (WC), Narrative Ratio (NR). An insignificant equation was found $F(5,7605)=1.06$, $p=0.378$, indicating that intrinsic attributes variables (FOG, ARI, FK, WC, NR) are not significant predictors of short-term performance (PA3).

- **T8:** A one-way between subjects ANOVA is conducted to compare the effect of intrinsic attributes cluster (C_INT) on performance within 21 days post-publication (PA21). Results indicate that there is a significant effect of intrinsic Form 10-K attributes on long-term performance $F(3,7612)=7.05$, $p<0.01$.

- **T9:** A post hoc Tukey test show that cluster 1 (M=-0.799, SD=10.981) differed significantly with a level of $P<0.01$ from cluster 2 (M=0.103, SD=10.648) and from cluster 3 (M=0.656, SD=9.596) and from cluster 4 (M=0.461, SD=8.513). However, cluster 2 (M=0.103, SD=10.648) does not differ significantly with P=0.238 from cluster 3 (M=0.656, SD=9.596) and from cluster 4 (M=0.461, SD=8.513) with P=0.719, and cluster 3 (M=0.656, SD=9.596) does not differ significantly with P=0.941 from cluster 4 (M=0.461, SD=8.513). This suggests that the significant difference between intrinsic attributes values for performance within 21 days post-publication (PA21) is caused due to cluster 1 values, while other clusters do not present significant differences.

- **T10:** A multiple linear regression is calculated to predict dependent variable PA21 (21 days performance) based on intrinsic attributes of Form 10-K (Readability and

Complexity groups): all readability indices (FOG, ARI, FK), Word Count (WC), Narrative Ratio (NR). A significant equation is found $F(5,7605)=7.57$, $p<0.01$ with an adjusted R^2 of 0.015. Intrinsic attributes variables (ARI, FK, NR) proved significant predictors of long-term performance (PA21), with $p<0.05$, while FOG, WC variable proved insignificant as a predictor. For β values analysis, see section 6.8.

The results indicate that intrinsic attributes, as manifested in intrinsic attribute cluster (C_INT) have a significant impact long-term performance, both from mean values perspective (T8 results), and as predictors (T10 results). Said results are caused by a single cluster (T9 results). This impact isn't significantly observed at the short-term, either from mean values perspective (T6 results) and as predictors (T7 results).

Results are demonstrated in table 21.

TABLE 21: RESULTS SUMMARY - INTRINSIC ATTRIBUTES IMPACT ON PERFORMANCE

Form 10-K Attributes Cluster	Short-Term	Long-term
ANOVA	**T6:** Short-term performance (PA3) F(3,7612)=1.651, p=0.175 Not-Significant	**T8:** Long-term performance (PA21) F(3,7612)=7.05 **
POST HOC TUKEY	Not applicable due to non-significant ANOVA results	**T9:** Long-term performance (PA21) Only cluster no. 1 **
LINEAR REGRESSION	**T7:** Short-term performance (PA3) F(5,7605)=1.06, p=0.378 Not-Significant	**T10:** Long-term performance (PA21) F(5,7605)=7.57 ** β: FOG insignificant, ARI negative, FK negative, WC insignificant, NR negative
** p<0.01		

6.6.3   Form 10-K external attributes impact on performance volatility

In order to establish the relationship of external attributes with short and long-term performance volatility, the following battery of tests is taken:

- **T11:** A one-way between subjects ANOVA is conducted to compare the effect of external attributes cluster (C_EXT) on performance volatility within three days post-publication (PA3_RSD). Results indicate that there is a significant effect of external Form 10-K attributes on short-term performance volatility $F(3,7612)=38.91$, $p<0.01$.

- **T12:** A post hoc Tukey test show that cluster 1 ($M=0.1982$, $SD=0.7657$) differed significantly with a level of $P<0.01$ from cluster 2 ($M=0.0954$, $SD=0.5729$) and from cluster 3 ($M=0.0136$, $SD=0.1237$) and from cluster 4 ($M=0.0037$, $SD=0.1242$), and that that cluster 2 ($M=0.0954$, $SD=0.5729$) differed significantly with a level of $P<0.01$ from cluster 4 ($M=0.0037$, $SD=0.1242$). However, cluster 3 ($M=0.0136$, $SD=0.1237$) does not differ significantly ($P=0.885$) from cluster 4 ($M=0.0037$, $SD=0.1242$). This suggests that the significant difference in external attributes values for performance volatility within three days post-publication (PA3_RSD) is caused due to differences among all clusters, excluding clusters 3 and 4 whose values do not present significant difference, meaning that the significance is not caused by a single cluster.

- **T13:** A multiple linear regression is calculated to predict dependent variable PA3_RSD (3 days performance volatility) based on external attributes of Form 10-K (Timing and Relations groups): Days to quarter 1 end (DQ), Peak proximity (PP), Concurrency (CN), Audit-tier (B4). A significant equation is found $F(5,7605)=38.03$, $p<0.01$ with an adjusted R square of 0.024. External attributes variables (DQ, PP, CN) proved significant predictors of short-term performance volatility (PA3_RSD), with $p<0.01$, while audit-tier variable (B4) proved insignificant as a predictor. For β values analysis, see section 6.8.

- **T14:** A one-way between subjects ANOVA is conducted to compare the effect of external attributes cluster (C_EXT) on performance volatility within 21 days post-publication (PA21_RSD). Results indicate that there isn't a significant effect of external Form 10-K attributes on short-term performance $F(3,7612)=1.420$, $p=0.235$.

- **T15:** A multiple linear regression is calculated to predict dependent variable PA21_RSD (21 days performance volatility) based on external attributes of Form 10-K (Timing and Relations groups): Days to quarter 1 end (DQ), Peak proximity (PP), Concurrency (CN), Audit-tier (B4). An insignificant equation was found

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F(5,7605)=0.85, p=0.514, indicating that external attributes variables (DQ, PP, CN, B4) are not significant predictors of long-term performance volatility (PA21_RSD).

The results indicate that external attributes, as manifested in external attribute cluster (C_EXT) have a significant impact short-term performance volatility, both from mean values perspective (T11 results), and as predictors (T13 results). Said results are not caused by a single cluster (T12 results). This impact isn't significantly observed at the long-term, either from mean values perspective (T14 results) and as predictors (T15 results).

Results are demonstrated in table 22.

TABLE 22: RESULTS SUMMARY - EXTERNAL ATTRIBUTES IMPACT OVER PERFORMANCE VOLATILITY

Form 10-K Attributes Cluster	Short-Term	Long-term
ANOVA	**T11:** Short-term performance volatility (PA3_RSD) F(3,7612)=38.91 **	**T14:** Long-term performance volatility (PA21_RSD) F(3,7612)=1.420, p=0.235 Not-Significant
POST HOC TUKEY	**T12:** Short-term performance volatility (PA3_RSD) Clusters pairs (1-2,1-3,1-4,2-4) ** Clusters pair (3-4) P=0.885	Not applicable due to non-significant ANOVA results
LINEAR REGRESSION	**T13:** Short-term performance volatility (PA3_RSD) F(5,7605)=38.03 ** β: B4 insignificant, PP positive, DQ positive, CN negative	**T15:** Long-term performance volatility (PA21_RSD) F(5,7605)=0.85, p=0.514 Not-Significant
** p<0.01		

6.6.4   Form 10-K intrinsic attributes impact on performance volatility

In order to establish the relationship of intrinsic attributes with short and long-term performance volatility, the following battery of tests is taken:

- **T16:** A one-way between subjects ANOVA is conducted to compare the effect of intrinsic attributes cluster (C_INT) on performance volatility within 3 days post-

publication (PA3_RSD). Results indicate that there isn't a significant effect of external Form 10-K attributes on short-term performance volatility $F(3,7612)=1.947$, $p=0.120$.

- **T17:** A multiple linear regression is calculated to predict dependent variable PA3_RSD (3 days performance) based on intrinsic attributes of Form 10-K (Readability and Complexity groups): all readability indices (FOG, ARI, FK), Word Count (WC), Narrative Ratio (NR). An insignificant equation was found $F(5,7605)=2.69$, $p=0.24$, indicating that intrinsic attributes variables (FOG, ARI, FK, WC, NR) are not significant predictors of short-term performance (PA3_RSD).

- **T18:** A one-way between subjects ANOVA is conducted to compare the effect of intrinsic attributes cluster (C_INT) on performance within 21 days post-publication (PA21_RSD). Results indicate that there isn't a significant effect of intrinsic Form 10-K attributes on long-term performance $F(3,7612)=1.43$, $p=0.231$.

- **T19:** A multiple linear was calculated to predict dependent variable PA21_RSD (21 days performance) based on intrinsic attributes of Form 10-K (Readability and Complexity groups): all readability indices (FOG, ARI, FK), Word Count (WC), Narrative Ratio (NR). An insignificant equation was found $F(5,7605)=1.47$, $p=0.207$, indicating that intrinsic attributes variables (FOG, ARI, FK, WC, NR) are not significant predictors of long-term performance (PA21_RSD).

The results indicate that intrinsic attributes, as manifested in intrinsic attribute cluster (C_INT) do not have a significant impact short-term performance, both from mean values perspective (T1 results), and as predictors (T2 results). This impact is also not significantly observed at the long-term, either from mean values perspective (T3 results) and as predictors (T4 results).

Results are demonstrated in table 23.

TABLE 23: RESULTS SUMMARY - INTRINSIC ATTRIBUTES IMPACT OVER PERFORMANCE VOLATILITY

Form 10-K Attributes Cluster	Short-Term	Long-term
ANOVA	**T16:** Short-term performance volatility (PA3_RSD)	**T18:** Long-term performance volatility (PA21_RSD)

	F(3,7612)=1.947, p=0.120 Not-Significant	F(3,7612)=1.43, p=0.231 Not-Significant
POST HOC TUKEY	Not applicable due to non-significant ANOVA results	Not applicable due to non-significant ANOVA results
LINEAR REGRESSION	**T17:** Short-term performance volatility (PA3_RSD) F(5,7605)=2.69, p=0.24 Not-Significant	**T19:** Long-term performance volatility (PA21_RSD) F(5,7605)=1.47, p=0.207 Not-Significant
** p<0.01		

6.6.5 Form 10-K attributes impact on performance ranking

In order to establish the relationship of external and intrinsic attributes with delta inter-publication performance ranking, the following battery of tests is taken:

- **T20:** A one-way between subjects ANOVA is conducted to compare the effect of external attributes cluster (C_EXT) on delta inter-publication performance ranking (ΔP_RNK). Results indicate that there isn't significant effect of external Form 10-K attributes on delta inter-publication ranking F(3,7612)=0.39, p=0.75.

- **T21:** A multiple linear regression is calculated to predict dependent variable ΔP_RNK (delta inter-publication ranking) based on external attributes of Form 10-K (Timing and Relations groups): Days to quarter 1 end (DQ), Peak proximity (PP), Concurrency (CN), Audit-tier (B4). An insignificant equation was found F(5,7605)=0.25, p=0.93, indicating that external attributes variables (DQ, PP, CN, B4) are not significant predictors of delta inter-publication ranking (ΔP_RNK).

- **T22:** A one-way between subjects ANOVA is conducted to compare the effect of intrinsic attributes cluster (C_INT) on delta inter-publication performance ranking (ΔP_RNK). Results indicate that there isn't significant effect of external Form 10-K attributes on delta inter-publication ranking F(3,7612)=0.67, p=0.56.

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- **T23:** A multiple linear regression is calculated to predict dependent variable ΔP_RNK (delta inter-publication ranking) based on intrinsic attributes of Form 10-K (Readability and Complexity groups): all readability indices (FOG, ARI, FK), Word Count (WC), Narrative Ratio (NR). An insignificant equation was found $F_{(5,7605)}=0.74$, $p=0.59$, indicating that intrinsic attributes variables (FOG, ARI, FK, WC, NR) are not significant predictors of delta inter-publication performance ranking (ΔP_RNK).

The results indicate that Form 10-K external and intrinsic attributes do not have a significant impact delta inter-publication performance ranking, both from a mean values perspective, and as predictors.

Results are demonstrated in table 24.

TABLE 24: RESULTS SUMMARY – ATTRIBUTES IMPACT OVER PERFORMANCE RANKING

Form 10-K Attributes Cluster	EXTERNAL	INTRINSIC
ANOVA	**T20:** Delta inter-publication performance ranking (ΔP_RNK) $F_{(3,7612)}=0.39$, $p=0.75$. Not-Significant	**T22:** Delta inter-publication performance ranking (ΔP_RNK) $F_{(3,7612)}=0.67$, $p=0.56$ Not-Significant
LINEAR REGRESSION	**T21:** Delta inter-publication performance ranking (ΔP_RNK) $F_{(5,7605)}=0.25$, $p=0.93$ Not-Significant	**T23:** Delta inter-publication performance ranking (ΔP_RNK) $F_{(5,7605)}=0.74$, $p=0.59$ Not-Significant

6.7 FORM 10-K ATTRIBUTES IMPACT ON VOLUME

6.7.1 Form 10-K external attributes impact on volume volatility

In order to establish the relationship of external attributes with short and long-term volume volatility, the following battery of tests is taken:

- **T24:** A one-way between subjects ANOVA is conducted to compare the effect of external attributes cluster (C_EXT) on volume volatility within three days post-publication (V3_RSD). Results indicate that there is a significant effect of external Form 10-K attributes on short-term volume volatility $F(3,7612)=25.52$, $p<0.01$.

- **T25:** A post hoc Tukey test show that all clusters differ significantly with a level of $P<0.01$. This suggests that the significance in ANOVA results is not caused by a single cluster.

- **T26:** A multiple linear regression is calculated to predict dependent variable V3_RSD (3 days volume volatility) based on external attributes of Form 10-K (Timing and Relations groups): Days to quarter 1 end (DQ), Peak proximity (PP), Concurrency (CN), Audit-tier (B4). A significant equation is found $F(5,7605)=463.08$, $p<0.01$ with an adjusted R^2 of 0.196. All external attributes variables (DQ, PP, CN, B4) proved significant predictors of short-term volume volatility (V3_RSD), with $p<0.01$. For β values analysis, see section 6.8.

- **T27:** A one-way between subjects ANOVA is conducted to compare the effect of external attributes cluster (C_EXT) on volume volatility within 21 days post-publication (V21_RSD). Results indicate that there isn't a significant effect of external Form 10-K attributes on short-term volume volatility $F(3,7612)=1.374$, $p=0.249$.

- **T28:** A multiple linear regression is calculated to predict dependent variable V21_RSD (21 days volume volatility) based on external attributes of Form 10-K (Timing and Relations groups): Days to quarter 1 end (DQ), Peak proximity (PP), Concurrency (CN), Audit-tier (B4). An insignificant equation was found $F(5,7605)=1.964$, $p=0.97$,

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indicating that external attributes variables (DQ, PP, CN, B4) are not significant predictors of long-term volume volatility (V21_RSD).

The results indicate that intrinsic attributes, as manifested in intrinsic attribute cluster (C_INT) have a significant impact short-term volume volatility, both from mean values perspective (T24 results), and as predictors (T26 results). Said results are not caused by a single cluster (T25 results). This impact isn't significantly observed at the long-term, either from mean values perspective (T27 results) and as predictors (T28 results).

Results are demonstrated in table 25.

TABLE 25: RESULTS SUMMARY - EXTERNAL ATTRIBUTES IMPACT OVER VOLUME VOLATILITY

Form 10-K Attributes Cluster	Short-Term	Long-term
ANOVA	**T24:** Short-term volume volatility (V3_RSD) F(3,7612)=25.52 **	**T27:** Long-term volume volatility (V21_RSD) F(3,7612)=1.374, p=0.249 Not-Significant
POST HOC TUKEY	**T25:** Short-term volume volatility (V3_RSD) all Clusters pairs **	Not applicable due to non-significant ANOVA results
LINEAR REGRESSION	**T26:** Short-term volume volatility (V3_RSD) F(5,7605)=463.08 ** β: PP positive, DQ negative, CN negative, B4 negative	**T28:** Long-term volume volatility (V21_RSD) F(5,7605)=1. 964, p=0. 97 Not-Significant
** p<0.01		

6.7.2   Form 10-K intrinsic attributes impact on volume volatility

In order to establish the relationship of external attributes with short and long-term volume volatility, the following battery of tests is taken:

- **T29:** A one-way between subjects ANOVA is conducted to compare the effect of intrinsic attributes cluster (C_INT) on volume volatility within three days post-

publication (V3_RSD). Results indicate that there is a significant effect of external Form 10-K attributes on short-term volume volatility $F_{(3,7612)}=40.18$, $p<0.01$.

- **T30:** A post hoc Tukey test show that all clusters differ significantly with a level of $P<0.01$. This suggests that the significance in ANOVA results is not caused by a single cluster.

- **T31:** A multiple linear regression is calculated to predict dependent variable V3_RSD (3 days volume volatility) based on intrinsic attributes of Form 10-K (Readability and Complexity groups): all readability indices (FOG, ARI, FK), Word Count (WC), Narrative Ratio (NR). A significant equation is found $F_{(5,7605)}=74.21$, $p<0.01$ with an adjusted R^2 of 0.046. Intrinsic attributes variables (FOG, ARI, FK, WC) proved significant predictors of short-term volume volatility (V3_RSD), with $p<0.05$, while only NR variable (Narrative Ratio) proved insignificant as a predictor. For β values analysis, see section 6.8.

- **T32:** A one-way between subjects ANOVA is conducted to compare the effect of external attributes cluster (C_INT) on volume volatility within 21 days post-publication (V21_RSD). Results indicate that there isn't a significant effect of external Form 10-K attributes on short-term volume volatility $F_{(3,7612)}=1.893$, $p=0.128$.

- **T33:** A multiple linear regression is calculated to predict dependent variable V21_RSD (21 days volume volatility) based on intrinsic attributes of Form 10-K (Readability and Complexity groups): all readability indices (FOG, ARI, FK), Word Count (WC), Narrative Ratio (NR). An insignificant equation was found $F_{(5,7605)}=3.025$, $p=0.10$, indicating Intrinsic attributes variables (FOG, ARI, FK, WC, NR) are not significant predictors of long-term volume volatility (V21_RSD).

The results indicate that intrinsic attributes, as manifested in intrinsic attribute cluster (C_INT) have a significant impact short-term volume volatility, both from mean values perspective (T29 results), and as predictors (T31 results). Said results are not caused by a single cluster (T30 results). This impact isn't significantly observed at the long-term, either from mean values perspective (T32 results) and as predictors (T33 results).

Results are demonstrated in table 26.

Form 10-K Attributes Cluster	Short-Term	Long-term
ANOVA	**T29:** Short-term volume volatility (V3_RSD) F(3,7612)=40.18**	**T32:** Long-term volume volatility (V21_RSD) F(3,7612)=1.893, p=0.128 Not-Significant
POST HOC TUKEY	**T30:** Short-term volume volatility (V3_RSD) all Clusters pairs **	Not applicable due to non-significant ANOVA results
LINEAR REGRESSION	**T31:** Short-term volume volatility (V3_RSD) F(5,7605)=74.21** β: NR insignificant, WC negative, FOG positive, ARI positive, FK positive	**T33:** Long-term volume volatility (V21_RSD) F(5,7605)=3.025, p=0.10 Not-Significant
** p<0.01		

6.7.3 Form 10-K attributes impact on volume ranking

In order to establish the relationship of external and intrinsic attributes with delta inter-publication volume ranking, the following battery of tests is taken:

- **T34:** A one-way between subjects ANOVA is conducted to compare the effect of external attributes cluster (C_EXT) on delta inter-publication ranking (ΔV_RNK). Results indicate that there is a significant effect of external Form 10-K attributes on delta inter-publication ranking $F_{(3,7612)}=2.683$, $p<0.05$.

- **T35:** A post hoc Tukey test show that except cluster 1, all clusters differed significantly with a level of $P<0.01$ meaning that the significance is not caused by a single cluster.

- **T36:** A multiple linear regression is calculated to predict dependent variable ΔV_RNK (delta inter-publication volume ranking) based on external attributes of Form 10-K (Timing and Relations groups): Days to quarter 1 end (DQ), Peak proximity (PP), Concurrency (CN), Audit-tier (B4). A significant equation is found $F_{(5,7605)}=19.57$, $p=<0.01$ with an adjusted R^2 of 0.019. External attributes variables (DQ, PP) proved significant predictors of delta inter-publication volume ranking (ΔV_RNK), with

p<0.05, while variables (B4, CN) proved insignificant as a predictor. For β values analysis, see section 6.8.

- **T37:** A one-way between subjects ANOVA is conducted to compare the effect of intrinsic attributes cluster (C_INT) on delta inter-publication volume ranking (ΔV_RNK). Results indicate that there is a significant effect of intrinsic Form 10-K attributes on delta inter-publication volume ranking $F(3,7612)=2.92$, $p<0.05$.

- **T38:** A post hoc Tukey test show that only cluster 4 (*M*=-0.111,*SD*=0.595) was significantly different from other clusters with a level of P<0.01 meaning that the significance is not caused by a single cluster. This suggests that the significant difference between intrinsic attributes values for delta inter-publication volume ranking (ΔV_RNK) is caused due to cluster 4 values, while other clusters do not present significant differences.

  T39: A multiple linear regression is calculated to predict dependent variable ΔV_RNK (delta inter-publication volume ranking) based on intrinsic attributes of Form 10-K (Readability and Complexity groups): all readability indices (FOG, ARI, FK), Word Count (WC), Narrative Ratio (NR). A significant equation is found $F(5,7605)=7.92$, $p<0.01$. All intrinsic attributes variables (FOG, ARI, FK, WC, NR) are significant predictors of delta inter-publication ranking (ΔV_RNK). For β values analysis, see section 6.8.

The results indicate that Form 10-K external and intrinsic attributes have a significant impact delta inter-publication volume ranking, both from a mean values perspective, and as predictors.

TABLE 27: RESULTS SUMMARY - ATTRIBUTES IMPACT OVER VOLUME RANKING

Test	Form 10-K External Attributes	Form 10-K Intrinsic Attributes
ANOVA	**T34:** Delta inter-publication volume ranking (ΔV_RNK) F(3,7612)=2.683 **	**T37:** Delta inter-publication volume ranking (ΔV_RNK) F(3,7612)=2.92 *
POST HOC TUKEY	**T35:** Delta inter-publication volume ranking (ΔV_RNK) all Clusters pairs **	**T38:** Delta inter-publication volume ranking (ΔV_RNK) Only cluster 4 **

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LINEAR REGRESSION	**T36:** Delta inter-publication volume ranking (ΔV_RNK) F(5,7605)=19.57** β: B4 insignificant, CN insignificant, PP negative, DQ positive	**T39:** Delta inter-publication volume ranking (ΔV_RNK) F(5,7605)=7.92 ** β: ARI negative, WC positive, FOG negative, FK negative, NR negative
** p<0.01, * p<0.05		

6.8 FORM 10-K ATTRIBUTES IMPACT SUMMARY

Intrinsic attributes: summarizing the statistically significant impacts found on the intrinsic attribute test at the previous section, the following impact directions are revealed by the β values in each (significant) regression model:

TABLE 28: BETA VALUES DIRECTIONS AND SIGNIFICANCE FOR INTRINSIC ATTRIBUTES

	FOG	ARI	FK	WC	NR
PA21	*Insignificant*	Negative	Negative	*Insignificant*	Negative
V3_RSD	Positive	Positive	Positive	Negative	*Insignificant*
ΔV_RNK	Negative	Negative	Negative	Positive	Negative

External attributes: summarizing the impact directions found on the external attribute test at the previous sections, the following significant directions of impact are revealed by the β values in each (significant) regression model:

TABLE 29: BETA VALUES DIRECTIONS AND SIGNIFICANCE FOR EXTERNAL ATTRIBUTES

	PP	DQ	CN	B4
PA3	Positive	Positive	Negative	Insignificant
PA3_RSD	Positive	Positive	Negative	Insignificant
V3_RSD	Positive	Negative	Negative	Negative
ΔV_RNK	Negative	Positive	Insignificant	Insignificant

This data is crosschecked using Pearson correlation between the variables.

As illustrated in tables 30 and 31, the Pearson correlation matrix matches the regression results (tables 28 and 29) in regard to the direction of impact of each respective variable.

TABLE 30: PEARSON CORRELATIONS FOR INTRINSIC ATTRIBUTES

	FOG	ARI	FK	WC	NR
PA21	*Insignificant*	-0.048**	-0.052**	*Insignificant*	-0.06**
V3_RSD	0.156**	0.121**	0.158**	-0.084**	*Insignificant*
ΔV_RNK	-0.025**	-0.026**	-0.036**	0.032**	-0.046**
** p<0.01					

TABLE 31: PEARSON CORRELATIONS FOR EXTERNAL ATTRIBUTES

	PP	DQ	CN	B4
PA3	0.138**	0.113**	-0.12**	Insignificant
PA3_RSD	0.133**	0.108**	-0.105**	Insignificant
V3_RSD	0.011**	-0.408**	-0.28**	-0.182**
ΔV_RNK	-0.026**	0.095**	Insignificant	Insignificant
** p<0.01				

6.9 HYPOTHESIS TESTING RESULTS

This section includes a summary of statistical test results obtained for each hypothesis, a resolution whether or not the hypothesis can be accepted, and additional conclusions deriving from the test results.

6.9.1   Hypothesis H1 corroboration

H1: Form 10-K reports audited by a first-tier ("Big 4") auditor are more complex (have a larger narrative ratio and are longer) and hard to read than reports audited by a non-first-tier auditor.

The following table summarizes results of tests performed in order to examine this hypothesis. Detailed statistical measures with larger elaboration can be found in section 6.4.

TABLE 32: SUMMARY OF AUDIT-TIER IMPACT ON FORM 10-K ATTRIBUTES (HYPOTHESIS H1)

Group	Sub-Group	Variable	T-Test / Mann-Whitney
Intrinsic	**Readability**	FOG	$t(7161.02)=-0.61$ (non-significant)
		ARI	$t(7296.18)=5.84$ **
		FK	$t(7296.18)=3.85$ **
	Complexity	WC	$z=18.37$ **
		NR	$z=20.70$ **
External	**Timing**	PP	$z=2.79$ **
		DQ	$z=24.03$ **
		CN	$z=2.16$ *
** $p<0.01$, * $p<0.05$			

The figures presented indicate there are significant differences between attributes of Form 10-K reports, when measured between groups of first-tier and non-first-tier auditors: readability attributes of Form 10-K reports as measured by the three readability indices (FOG, ARI, FK), show that there is a difference in relation to audit-tier (with a positive

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and significant effect as hypothesized) only for the ARI and FK indices. As can be seen at the table above, Gunning Fog readability index is an exception, being the only attribute which doesn't present a significant difference between the said groups.

This indicates that Form 10-K reports audited by first-tier auditors are harder to read when measured against ARI and FK, than reports audited by non-first-tier auditors, while measuring readability by FOG does not present significant results.

Form 10-K complexity, as measured by Word Count and Narrative Ratio, show difference in relation to audit-tier (with a positive and significant effect as hypothesized). This indicates that Form 10-K reports audited by first-tier auditors are more complex than reports audited by non-first-tier auditors.

In addition, although not hypothesized, test results show that Form 10-K timing attributes as measured by Peak Proximity, Days for quarter 1 end, and Concurrency also differ in relation to audit-tier, with a positive and significant effect. This indicates that Form 10-K reports audited by first-tier auditors are published in larger distance from peaks than reports audited by non-first-tier auditors, in larger proximity to the beginning of the year, and with larger concurrency[63].

Hypothesis H1 is rejected (cannot be accepted in full) due to the non-significant results of the Gunning Fog readability among audit-tiers. However, it may be concluded that Form 10-K reports audited by a first-tier auditor are more complex (have a larger narrative ratio and are longer), have larger timing values, and are harder to read when measured using ARI or FK, than reports audited by a non-first-tier auditor.

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[63] These results may be attributed to SEC regulation binding large (>$700M public float) firms to accelerated publication with 60 days' time-span, which in turn causes a shift specifically among first-tier customers (which as mentioned audit larger firms). The Concurrency significant difference may also be explained in a similar manner, since medium and small firms (between $70M to $700M public float, <$70M, accordingly) have separate presentation period in 75 and 90 days, which causes the load (and the concurrency) to reduce, being split into two different presentation deadlines.

The expected and found effects are described at the following table. As indicated, except FOG readability index, a positive and significant effect is supported in all attributes of the Form 10-K report.

VARIABLE			Expected Effect	Effect	Verification
Group	Sub-Group	Name			
Intrinsic	Readability	FOG	Direct, positive	Negative (insignificant)	Not Supported
		ARI	Direct, positive	Positive (significant)	**Supported**
		FK	Direct, positive	Positive (significant)	**Supported**
	Complexity	WC	Direct, positive	Positive (significant)	**Supported**
		NR	Direct, positive	Positive (significant)	**Supported**
External	Timing	PP	Not Hypothesized	Positive (significant)	**Supported**
		DQ	Not Hypothesized	Positive (significant)	**Supported**
	Relational	CN	Not Hypothesized	Positive (significant)	**Supported**

In addition, the following results relating to variable properties are discovered during the data analysis process (elaborated in section 6.5):

Comparison	All	Non-First-Tier	First-Tier
Word Count and FOG	0.125 **	0.084 **	0.157 **
Word Count and ARI	0.135 **	0.091 **	0.146 **
Word Count and FK	0.151 **	0.125 **	0.158 **
Narrative Ratio and FOG	0.401 **	0.341 **	0.455 **
Narrative Ratio and ARI	0.456 **	0.393 **	0.486 **
Narrative Ratio and FK	0.498 **	0.442 **	0.537 **
Concurrency and Peak Proximity	-0.635 **	-0.607 **	-0.658 **
Concurrency and Days to quarter 1 end	-0.206 **	-0.084 **	-0.320 **
** P<0.01			

As indicated from data presented in table 34, there are several inter-variable relationships flowing from different audit-tier: Narrative Ratio is positively related to all three readability indices, with significant positive Pearson correlation values of medium-strong weight (r=0.401 to 0.498), both affected by Audit-Tier. Word Count is positively related to all three readability indices, with significant positive Pearson correlation values of weak weight (r=0.125 to 0.151), both affected by Audit-Tier. Concurrency is negatively related to Peak Proximity with significant negative Pearson correlation values of strong weight (r=-0.635) and to Days from quarter 1 end with significant negative Pearson correlation values of weak weight (r=-0.206), both affected by Audit-Tier.

6.9.2 Hypothesis H2 corroboration

H2: Form 10-K reports present a consistent multi-year trend in which reports are growing more complex (have a larger narrative ratio and are longer) and hard to read.

The following table summarizes results of tests performed in order to examine this hypothesis. Detailed statistical measures with larger elaboration can be found in section <u>6.3</u>.

TABLE 35: SUMMARY OF FORM 10-K ATTRIBUTES TREND TEST RESULTS (HYPOTHESIS H2)

Group	Sub-Group	Variable	Jonckheere-Terpstra
Intrinsic	**Readability**	FOG	$F(10,7618)=26.04$ **
		ARI	$F(10,7618)=23.89$ **
		FK	$F(10,7618)=26.92$ **
	Complexity	WC	$F(10,7618)=33.53$ **
		NR	$F(10,7618)=15.87$ **
External	**Timing**	PP	$F(10,7618)=19.21$ **
		DQ	$F(10,7618)=15.95$ **
		CN	$F(10,7618)=-0.02$ (non-significant)
** p<0.01			

The figures presented indicate that there is a significant trend in attributes of Form 10-K reports when measured during the ten-year time span of this study: Form 10-K readability, as measured by the three readability indices (FOG, ARI, FK) show a positive and significant trend, in which reports are growing harder to read with years, as hypothesized.

Form 10-K complexity, as measured by Word Count and Narrative Ratio, show a positive and significant trend, in which reports are growing harder to read with years, as hypothesized.

Therefore, hypothesis 2 is accepted.

The expected effects and found effects are described at the following table:

TABLE 36: SUMMARY OF TEST RESULTS (HYPOTHESIS H2)

VARIABLE			Expected Effect	Effect	Verification
Group	Sub-Group	Name			
Intrinsic	Readability	FOG	Direct, positive	Positive (significant)	**Supported**
		ARI	Direct, positive	Positive (significant)	**Supported**
		FK	Direct, positive	Positive (significant)	**Supported**
	Complexity	WC	Direct, positive	Positive (significant)	**Supported**
		NR	Direct, positive	Positive (significant)	**Supported**
External	Timing	PP	Not Hypothesized	Positive (significant)	**Supported**
		DQ	Not Hypothesized	Positive (significant)	**Supported**
	Relational	CN	Not Hypothesized	Negative (insignificant)	Not Supported

In addition, Form 10-K timing attributes, as measured by Peak Proximity, Days for quarter 1 end, and Concurrency are also tested for trend. Although not hypothesized, test results indicate that there is a significant trend for both Peak Proximity, Days for quarter 1 end, while Concurrency values do not show a significant trend.

Therefore, it may be further concluded that Form 10-K reports are presenting a consistent multi-year trend in which reports are growing more complex (have a larger narrative ratio and are longer), are harder to read, are published with larger distance

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from publication peaks and are published with growing distance from the first quarter's end.

6.9.3   Hypothesis H3 corroboration

H3: Short-term stock performance and its volatility are affected by external attributes of Form 10-K report publications.

The following table summarizes results of tests performed in order to examine this hypothesis. Detailed statistical measures with larger elaboration can be found in sections 6.6.1 and 6.6.3.

TABLE 37: SUMMARY OF EXTERNAL ATTRIBUTES IMPACT TEST RESULTS (HYPOTHESIS H3)

Type		Short-term tests for Form 10-K External Attributes
Performance	ANOVA	**T1:** Short-term performance (PA3) $F(3,7612)=56.73$ **
	POST HOC TUKEY	**T2:** Short-term performance (PA3) Clusters pairs (1-2,1-3,1-4,2-4) ** Clusters pair (3-4) P=0.932 (Not-Significant)
	LINEAR REGRESSION	**T3:** Short-term performance (PA3) $F(5,7605)=42.68$ ** β: B4 insignificant, DQ positive, PP positive, CN negative
Performance Volatility	ANOVA	**T11:** Short-term performance volatility (PA3_RSD) $F(3,7612)=38.91$ **
	POST HOC TUKEY	**T12:** Short-term performance volatility (PA3_RSD) Clusters pairs (1-2,1-3,1-4,2-4) ** Clusters pair (3-4) P=0.885
	LINEAR REGRESSION	**T13:** Short-term performance volatility (PA3_RSD) $F(5,7605)=38.03$ ** β: B4 insignificant, DQ positive, PP positive, CN negative

The results indicate that external attributes, as manifested in external attribute cluster (C_EXT) have a significant impact on short-term performance and short-term performance volatility, both from mean values perspective (T1 results for performance and T11 results for performance volatility), and as predictors (T3 results for performance and T13 results

for performance volatility). Said results are not caused by a single cluster (T2 results for performance and T12 results for performance volatility).

This indicates that investors reactions on the short-term (3 days from publication) are (statistically significant) positively influenced by the external attributes of the Form 10-K (which contain the Timing and Relational sub-groups).

Short-term performance (dependent variable PA3) and Short-term performance volatility (dependent variable PA3_RSD) are affected by external attributes. Peak proximity and days to quarter 1 end (independent variables PP, DQ) have a positive impact, while concurrency (independent variable CN) has a negative impact.

Therefore, hypothesis 3 is accepted.

6.9.4   Hypothesis H4 corroboration

H4: Long-term stock performance and its volatility are affected by intrinsic, content related attributes (readability, complexity) of Form 10-K report publications.

The following table summarizes results of tests performed in order to examine this hypothesis. Detailed statistical measures with larger elaboration can be found in sections 6.6.2 and 6.6.4.

TABLE 38: SUMMARY OF INTRINSIC ATTRIBUTES IMPACT TEST RESULTS (HYPOTHESIS H4)

Type		Long-term tests for Form 10-K Intrinsic Attributes
Performance	ANOVA	**T8:** Long-term performance (PA21) $F_{(3,7612)}=7.05$ **
	POST HOC TUKEY	**T9:** Long-term performance (PA21) Only cluster no. 1 **
	LINEAR REGRESSION	**T10:** Long-term performance (PA21) $F_{(5,7605)}=7.57$ ** β: FOG insignificant, ARI negative, FK negative, WC insignificant, NR negative

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Performance Volatility	ANOVA	**T18:** Long-term performance volatility (PA21_RSD) F(3,7612)=1.43, p=0.231 (Not-Significant)
	LINEAR REGRESSION	**T20:** Long-term performance volatility (PA21_RSD) F(5,7605)=1.47, p=0.207 (Not-Significant)

The results indicate that intrinsic attributes, as manifested in intrinsic attribute cluster (C_INT) have a significant impact long-term performance, both from mean values perspective (T8 results for performance), and as predictors (T10 results for performance). Said results are caused by a single cluster, number 1 (T9 results for performance).

In addition, the results indicate that intrinsic attributes, as manifested in intrinsic attribute cluster (C_INT) do not have a significant impact long-term performance volatility, both from mean values perspective (T18 results for performance volatility), and as predictors (T20 results for performance volatility).

This indicates that investors reactions for the long-term (21 days from publication) are (statistically significant) positively influenced by the intrinsic attributes of the Form 10-K (which contain the Complexity and Readability sub-groups) only in respect for performance, and that investors reactions for the long-term (21 days from publication) are not influenced significantly by the intrinsic attributes of the Form 10-K in respect for performance volatility.

Therefore, hypothesis 4 cannot be accepted in full due to the non-significant results of the performance volatility reactions.

However, it may be concluded that long-term stock performance is affected by several intrinsic attributes. Automatic readability index, Flesch-Kincaid readability and narrative ratio (independent variables ARI, FK, NR) have a (statistically significant) negative impact on the long-term performance of the Form 10-K reports.

6.9.5   Hypothesis H5 corroboration

H5: Investors' reaction to Form 10-K reports is expressed differently in the short-term and in the long-term.

The following table summarizes results of tests performed in order to examine this hypothesis. Detailed statistical measures with larger elaboration can be found in sections 6.6.1 and 6.6.2.

TABLE 39: SUMMARY OF SHORT-TERM AND LONG-TERM IMPACT TEST RESULTS (HYPOTHESIS H5)

Test	Form 10-K Attributes Cluster	Significant	Not-Significant
ANOVA	External	**T1** External**:** <u>Short-term</u> performance (PA3) F(3,7612)=56.73 **	**T4** External**:** <u>Long-term</u> performance (PA21) F(3,7612)=0.328, p=0.805 Not-Significant
POST HOC TUKEY		**T2** External**:** <u>Short-term</u> performance (PA3) Clusters pairs (1-2,1-3,1-4,2-4) **	Not applicable due to non-significant ANOVA results
LINEAR REGRESSION		**T3** External**:** <u>Short-term</u> performance (PA3) F(5,7605)=42.68 ** β: B4 insignificant, DQ positive, PP positive, CN negative	**T5** External**:** <u>Long-term</u> performance (PA21) F(5,7605)=1.17, p=0.312 Not-Significant
ANOVA	Intrinsic	**T8** Intrinsic**:** <u>Long-term</u> performance (PA21) F(3,7612)=7.05 **	**T6** Intrinsic**:** <u>Short-term</u> performance (PA3) F(3,7612)=1.651, p=0.175 Not-Significant
POST HOC TUKEY		**T9:** <u>Long-term</u> performance (PA21) Only cluster no. 1 **	Not applicable due to non-significant ANOVA results
LINEAR REGRESSION		**T10** Intrinsic**:** <u>Long-term</u> performance (PA21) F(5,7605)=7.57 ** β: FOG insignificant, ARI negative, FK negative, WC insignificant, NR negative	**T7** Intrinsic**:** <u>Short-term</u> performance (PA3) F(5,7605)=1.06, p=0.378 Not-Significant
** p<0.01			

As demonstrated in table 39, intrinsic attributes produce significant results only at the long-term, while external attributes produce significant results only at the short-term.

In addition, the results indicate that external attributes, as manifested in external attribute cluster (C_EXT) have a significant impact short-term performance, both from mean values perspective (T1 external results for performance), and as predictors (T3 external results for performance). Said results are not caused by a single cluster (T2 intrinsic results for performance). On the other hand, external attributes do not have a significant impact short-

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term performance, both from mean values perspective (T5 external results for performance), and as predictors (T6 external results for performance).

The results indicate that intrinsic attributes, as manifested in intrinsic attribute cluster (C_INT) have a significant impact long-term performance, both from mean values perspective (T8 intrinsic results for performance), and as predictors (T10 intrinsic results for performance). Said results are caused by a single cluster, number 1 (T9 intrinsic results for performance). On the other hand, intrinsic attributes do not have a significant impact short-term performance, both from mean values perspective (T6 intrinsic results for performance), and as predictors (T7 intrinsic results for performance).

Therefore, hypothesis 5 is accepted. It may be concluded that Investors' reaction to Form 10-K reports is expressed differently in the short-term and in the long-term, having intrinsic attributes produce significant results only at the long-term, while external attributes produce significant results only at the short-term.

6.9.6   Hypothesis H6 corroboration

H6: Complex and less readable Form 10-K report publications have a negative effect on trade <u>volume</u> volatility.

The following table summarizes results of tests performed in order to examine this hypothesis. Detailed statistical measures with larger elaboration can be found in section [6.7](#).

TABLE 40: SUMMARY OF INTRINSIC ATTRIBUTES VOLUME IMPACT TEST RESULTS (HYPOTHESIS H6)

Form 10-K Attributes Cluster	Short-Term	Long-term
ANOVA	**T29:** Short-term volume volatility (V3_RSD) $F(3,7612)=40.18$**	**T32:** Long-term volume volatility (V21_RSD) $F(3,7612)=1.893$, $p=0.128$ Not-Significant
POST HOC TUKEY	**T30:** Short-term volume volatility (V3_RSD) all Clusters pairs **	Not applicable due to non-significant ANOVA results

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LINEAR REGRESSION	**T31:** Short-term volume volatility (V3_RSD) F(5,7605)=74.21** β: NR insignificant, WC negative, FOG positive, ARI positive, FK positive	**T33:** Long-term volume volatility (V21_RSD) F(5,7605)=3.025, p=0.10 Not-Significant
** p<0.01		

As demonstrated in table 40, intrinsic attributes produce significant results only at the short-term.

The results indicate that intrinsic attributes, as manifested in intrinsic attribute cluster (C_INT) have a significant impact on short-term volume volatility, both from mean values perspective (T29 intrinsic results for volume volatility), and as predictors (T31 intrinsic results for volume volatility). Said results are caused by all clusters (T30 intrinsic results for volume volatility). On the other hand, intrinsic attributes do not have a significant impact long-term volume volatility, both from mean values perspective (T32 intrinsic results for volume volatility), and as predictors (T33 intrinsic results for volume volatility).

Therefore, hypothesis 6 cannot be accepted. The results show that investors' reaction to Form 10-K reports intrinsic attributes (readability and complexity) is expressed in the short-term volume volatility, with positive significant relation, and has no significant effect at the long-term.

Results are demonstrated at the following table:

TABLE 41: SUMMARY OF TEST RESULTS (HYPOTHESIS H6)

Group	Name	Expected Effect	Effect	Verification
Intrinsic	Volume volatility	Direct, negative	Positive (significant), for short-term volume volatility Positive (Non-significant), for long-term volume volatility	Not-Supported

In addition, test results show that volume volatility was examined in front of external Form 10-K attributes.

The following table summarizes results of tests conducted (elaborated in section 6.7.1)

TABLE 42: SUMMARY OF EXTERNAL ATTRIBUTES VOLUME IMPACT TEST RESULTS (HYPOTHESIS H6)

Form 10-K Attributes Cluster	Short-Term	Long-term
ANOVA	**T24:** Short-term volume volatility (V3_RSD) F(3,7612)=25.52 **	**T27:** Long-term volume volatility (V21_RSD) F(3,7612)=1.374, p=0.249 Not-Significant
POST HOC TUKEY	**T25:** Short-term volume volatility (V3_RSD) all Clusters pairs **	Not applicable due to non-significant ANOVA results
LINEAR REGRESSION	**T26:** Short-term volume volatility (V3_RSD) F(5,7605)=463.08 ** β: PP positive, DQ negative, CN negative, B4 negative	**T28:** Long-term volume volatility (V21_RSD) F(5,7605)=1. 964, p=0. 97 Not-Significant
** p<0.01		

As demonstrated, intrinsic attributes produce significant results only at the short-term. The results indicate that external attributes, as manifested in external attribute cluster (C_EXT) have a significant impact on short-term volume volatility, both from mean values perspective (T24 results for volume volatility), and as predictors (T26 results for volume volatility). Said results are caused by all clusters (T25 results for volume volatility). On the other hand, intrinsic attributes do not have a significant impact long-term volume volatility, both from mean values perspective (T27 results for volume volatility), and as predictors (T28 results for volume volatility).

Although not hypothesized, test results reveal that investors' reaction to Form 10-K reports external attributes (Timing and Relational) is expressed in the short-term volume volatility, with positive significant relation, and has no significant effect at the long-term.

In addition, test results show that volume changes manifested in Delta inter-publication volume ranking were also examined in from on both external and intrinsic attributes.

The following table summarizes results of tests conducted (elaborated in section 6.7.3)

TABLE 43: SUMMARY OF INTRINSIC ATTRIBUTES VOLUME IMPACT TEST RESULTS (HYPOTHESIS H6)

Test	Form 10-K External Attributes	Form 10-K Intrinsic Attributes
ANOVA	**T34:** Delta inter-publication volume ranking (ΔV_RNK) F(3,7612)=2.683 **	**T37:** Delta inter-publication volume ranking (ΔV_RNK) F(3,7612)=2.92 *
POST HOC TUKEY	**T35:** Delta inter-publication volume ranking (ΔV_RNK) all Clusters pairs **	**T38:** Delta inter-publication volume ranking (ΔV_RNK) Only cluster 4 **
LINEAR REGRESSION	**T36:** Delta inter-publication volume ranking (ΔV_RNK) F(5,7605)=19.57** β: B4 insignificant, CN insignificant, PP negative, DQ positive	**T39:** Delta inter-publication volume ranking (ΔV_RNK) F(5,7605)=7.92 ** β: ARI negative, WC positive, FOG negative, FK negative, NR negative
** p<0.01, * p<0.05		

As demonstrated, both external and intrinsic attributes produce significant results. The results indicate that external attributes, as manifested in external attribute cluster (C_EXT) have a significant impact on Delta inter-publication volume ranking, both from mean values perspective (T34 intrinsic results for ΔV_RNK), and as predictors (T36 intrinsic results for ΔV_RNK). Said results are caused by all clusters (T35 intrinsic results for ΔV_RNK).

The results indicate that intrinsic attributes, as manifested in intrinsic attribute cluster (C_INT) have a significant impact on Delta inter-publication volume ranking, both from mean values perspective (T37 intrinsic results for ΔV_RNK), and as predictors (T6 intrinsic results for ΔV_RNK). Said results are caused by cluster 4 (T38 intrinsic results for ΔV_RNK).

Therefore, the following is concluded:

Short-term volume volatility (dependent variable V3_RSD) is affected by both intrinsic and external attributes. All readability indices and the peak proximity (independent variables FOG, ARI, FK, PP) have a positive impact on short-term volume volatility, while word count, concurrency and days to quarter 1 end have a negative impact (independent variables WC, DQ, CN) on short-term volume volatility. These effects are statistically significant at p<0.01, and medium in strength, reflecting at the adjusted R^2=0.196 value.

Delta inter-publication volume ranking (dependent variable ΔV_RNK) is affected by both intrinsic and external attributes. All readability indices, the narrative ratio and the peak proximity (independent variables FOG, ARI, FK, NR, PP) have a negative impact on delta inter-publication volume ranking, while word count, concurrency and days to quarter 1 end (independent variables WC, DQ, CN) have a positive impact on Delta inter-publication volume ranking.

Note: since the ranking scale is reversed (see section 5.4.3), hence smaller ranking means higher values, the short-term volume volatility and delta inter-publication volume ranking results mentioned above are aligned.

7. CHAPTER VII: DISCUSSION

7.1 ACHIEVING RESEARCH OBJECTIVES

7.1.1 Methodology

As described on section 5.5.1, Form 10-K attributes are divided in this study to two types of attributes:

- **Intrinsic attributes**, which depend only on the periodic report itself, and doesn't relate to external events, describing complexity and readability of the text for readers, and deriving from the narrative characteristics of the report.
- **External attributes**, deriving from different parties as regulatory authorities, other firms and auditors (for example, publication load concurrency and peak publication proximity). These attributes derive from circumstantial events such as concurrency of publications made by other firms.

This attribute split is adopted following on the notion deducted from the literature review, in which intrinsic attributes related data requires more time and resources to digest, since it resides in long and complex narrative text. In opposite, the external attributes are more immediate, since they require less effort to process (for example, information regarding the auditor's identity, or assessing a specific firm for coping with the regulated deadline and not being late).

In order to measure the impact of said attributes on trade as accurately as possible, the following three-dimensional matrix is formulated:

- **Dimension 1 – measure performance and volume:** measurement of reports publication impact as reflected in both trade volume and trade performance.
- **Dimension 2 – measure change, volatility and ranking:** measurement of figures in three types of relation - an aggregate percentage change which is specific for the

time of the publication, a volatility change which compares the latter against historic figures (hence providing a benchmark), and a ranking change figure to compare between the pre/post publication time frames in terms of ranks (see ranking section).

- **Dimension 3 – measure short and long-terms:** measurement of aggregated figures within short and long-term, defined as a cumulative impact over 3 and 21 days post-publication, respectively.

Permutations of all possible dimensions offer precise means to estimate the effect of the reports, as it is manifested in practice on trade characteristics (volume, performance and their volatility).

7.1.2 First research objective

The first objective of this study is assessing the relevance of Form 10-K reports for investors. In order to estimate this relevance, this study uses measurements of report's impact on investors' behavior, and determines the nature of attributes and factors in which this impact comes to a realization.

This objective is accordingly translated into two research questions:

- **How do post-publication effects of Form 10-K reports manifest themselves over time?**
- **How do Form 10-K report publications affect trade volume?**

The related hypotheses were formulated following a comprehensive review of existing literature over the subject at hand formulated (see sections 3.3 and 3.4). An assumption is made in which the two attribute groups (external and intrinsic) present significantly different outcomes. This assumption is encompassed at the hypotheses, which relate specifically to differences between attribute groups. The hypotheses are formulated in order to answer the research questions above with sufficient granularity, which in turn will offer a more accurate understanding of relations between the report publications and the market changes (from volume and performance perspectives):

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H3: Short-term stock performance and its volatility are affected by external attributes of Form 10-K report publications.

H4: Long-term stock performance and its volatility are affected by intrinsic, content related attributes (readability, complexity) of Form 10-K report publications.

H5: Investors' reaction to Form 10-K reports is expressed differently in the short-term and in the long-term.

H6: Complex and less readable Form 10-K report publications have a negative effect on trade volume volatility.

The **expected** outcomes (reflected in the hypotheses formulated) is that on the short-term investors react specifically to the publication event, while the content of the report comes to significance only at the long-term.

The results show several conclusions matching the expected outcomes:

- Short-term stock performance and its volatility are affected by external attributes of Form 10-K report publications (as described in section 6.9.3).
- Long-term stock performance is affected by intrinsic, content related (intrinsic) attributes of the Form 10-K reports (as described in section 6.9.4).
- Investors' reaction to Form 10-K reports is expressed differently in the short-term and in the long-term (as described in section 6.9.5).

First and foremost, it is successfully corroborated that there is a hindsight justification for using the mentioned three dimensions of measurement, since statistically significant results are achieved by using them as a framework for models.

As expected, the impact of the Form 10-K reports is indeed significantly different when observed at the short and long-terms, and when relating to the two groups of attributes, investors are reacting on the short-term specifically to the publication event, while the content of the report comes to significance only at the long-term. The results show that the

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intrinsic attributes, which are content related, comes to significance only at the long-term, while short-term is affected by external attributes.

However, part of the results failed to meet the expected outcomes:

- The long-term stock effect made by intrinsic, content related attributes (readability, complexity) of the Form 10-K reports was found to be significant only for performance, while the performance volatility effects were not significant.
- Attributes effects on volume volatility (as described in section 6.7.2) are found to be expressed only in the short-term, and has no significant effect at the long-term.

Since the point of interest (as mentioned in the first research objective) is to assess the relevance of reports for investors by measuring their impact, particular emphasis is given for discussion as of the specific factors from which this impact is made of.

Short-term impact is hypothesized and confirmed to be affected from external attributes. Examining data with larger granularity show that the short-term impact on performance and its volatility is driven by the load of reports on investors.

The load of reports is manifested in three different aspects – the concurrency of reports being published in the same day, the proximity of the publication date to the regulated deadlines, and the publication's proximity to the first quarter's end. All of these aspects may be combined to describe a specific state investors are facing, which is the necessity to deal with a concurrent and considerable amount of data in a short time-span.

Long-term impact is hypothesized and confirmed to be affected from intrinsic attributes. Examining data with larger granularity show that the long-term impact on performance is driven by the information digesting resources required from investors to extract valuable content from the reports. The resources required to extract report information are manifested in two different aspects – from a readability perspective, as measured by Automatic text readability index and Flesch-Kincaid index (FOG index proved insignificant in several tests), and from a complexity perspective, as measured by the narrative ratio. As with the external attributes, these two aspects may be combined to

describe a situation which investors are facing, which is the necessity to have information digesting resources capacity and the ability to allocate it, in order to handle the reports.

As may be concluded from the evidence presented and illustrated at the figure below, larger reports load is actually reducing the impact of the reports on investors (short-term). Similarly, the intricacy of reports is also reducing the impact of the reports on investors (long-term).

FIGURE 30: FORM 10-K ATTRIBUTES IMPACT DIAGRAM
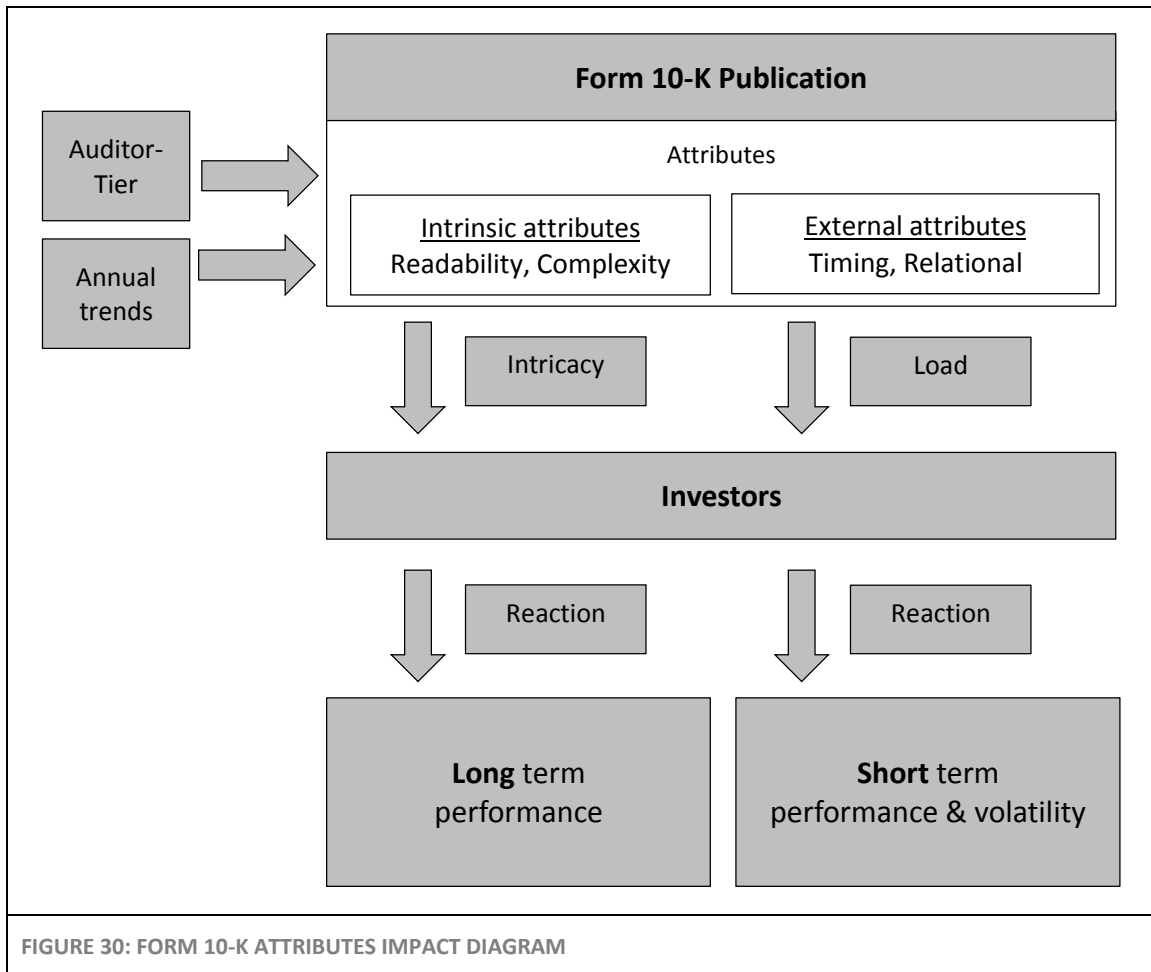
Hence, addressing the first research objective, it is deducted that reports load and report intricacy are reducing the relevance of reports for investors, and that this mitigation exists on different time-spans (short for load impact, long for intricacy impact).

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It should be noted that these relationships apply to performance rather than volume: when relating to volume volatility in specific, the results show that report publications impact is restricted to the short-term. In difference with the performance results mentioned, the impact on volume volatility is rather composed by both types of attributes (external and intrinsic). In common with the performance results mentioned, effects are an outcome of both load and intricacy aspects: from volume volatility perspective, larger reports load is reducing the impact of the reports on investors. Similarly, intricate reports are also reducing the impact of the reports on investors.

Conclusions relate to reports word count as operating in the reverse direction from the readability indices (meaning, while hard to read reports magnify volume volatility, longer reports actually reduces it). It may be argued that since this phenomenon is limited to the short-term, it is caused by the effect of longer reports, symbolizing for investors that a rigorous process of scrutiny was conducted by the auditor, and that accurate and elaborated reporting has been done. In turn, this reduces the volume volatility by assuring investors that the auditor has performed his role faithfully.

The evidence presented lead toward the following conclusion, which is based on the notion that reports handling depend on investors' information digestion abilities, and therefore are linked with the relevance of reports for investors:

The relevance of Form 10-K reports for investors is a significant direct outcome of the requirements reports present to investors, from load and intricacy aspects.

Accordingly, the relationship between relevance and requirements is negative in nature, hence, reports presenting fewer requirements will yield more relevance, manifested in larger impact.

7.1.3   Second research objective

The second objective of this study is to offer a better understanding of the market eco-system. This objective is achieved by assessing consistent and significant multi-year

trends relating to the different attributes of Form 10-K reports, and examining the nature of relationships between the latter.

This objective is translated into two research questions:

- **What impact do auditors in general, and auditors' tier in specific have on the composition and attributes of the Form 10-K report?**
- **How do Form 10-K reports characteristics change over time?**

Reviewing the existing literature, the following observations are made:

- Auditors differ significantly when segmented into audit-tiers: first audit tier is incentivized toward better audits, more successful in restraining clients for regulations and timekeeping, has larger independence and employ more scrutiny over its clients. As a result, it is expected that the differences between audit-tiers may not be confined for scrutiny of clients, but will also be reflected in written audit reports, meaning, as the scrutiny is larger among the first-tier auditors, so will be the extent of reporting, which is expected to be thrall, intensive and contain elaborate discussion over all aspects of the audit.
- Market growth and technological advancement trends observed at the market, will manifest themselves in the composition and characteristics of Form 10-K reports: with larger resources at their disposal, larger capacity and capabilities and larger clients to audit, audit firms are expected to present a higher quality of audits with time.

In turn, the hypotheses are formulated (see sections 3.1 and 3.2) following a review of existing literature in order to provide insight with specific attention given to the auditor role and impact over the reports, and the changing process of reports within the examined decade:

- **H1**: Form 10-K reports audited by a first-tier ("Big 4") auditor are more complex (have a larger narrative ratio and are longer) and hard to read than reports audited by a non-first-tier auditor.

- **H2**: Form 10-K reports present a consistent multi-year trend in which reports are growing more complex (have a larger narrative ratio and are longer) and hard to read.

The expected outcomes are all supported, with the exception of FOG readability related results which are insignificant. The test results show evidence for the following:

Form 10-K reports audited by first-tier auditors are more complex (have a larger narrative ratio and are longer), have larger timing values, and are harder to read when measured using Automatic or Flesch-Kincaid readability indices than reports audited by non-first-tier auditors. Form 10-K reports present a consistent multi-year trend in which reports are growing more complex (have a larger narrative ratio and are longer), are harder to read, are published with larger distance from publication peaks and are published with growing distance from the first quarter's end.

The evidence presented leads toward the following conclusion, answering the two research questions: the requirements of information extraction from Form 10-K reports are on a growing trend, showing larger intricacy and load with years. In addition, these requirements are significantly higher within Form 10-K reports of firms audited by a first-tier auditor.

7.1.4   Third research objective

The third objective of this study relates to the value encompassed within the findings of this study: this objective sets to examine how the results reached in this study may produce additional value for investors which is currently unexploited, by offering a better understanding of the investor-auditor-company triangle (hence adding to report's relevance).

In order to assess the potential relevance and value of the findings, a preliminary discussion has to be made on the role which annual reports serve. Annual reports act as a channel of information between firms and shareholders. These reports contain elaborated information about the company's activities and performance, and discussions over any topic which can

be deemed relevant to the company's business, for example, environmentally or socially sensitive operations. Investors scrutinize annual reports in search for relevant information for making investments decisions. After being read with a great deal of expertise, valuable insights can be extracted from the annual reports. For example, reading a multi-year series of annual reports of a particular company may reveal whether management is successful in implementing declared plans and strategies. In addition, it may prove in hindsight how transparent and truthful are the company's disclosures made within the reports. Footnotes at the report may provide in-depth information for debt and liabilities origins. Risk factors section may highlight particular risks that investors are not aware of. In addition, compensation and incentives for management are elaborated within the reports, so investors can examine what exactly are the personal motives of the company's management. In-depth inquiries of annual reports as described above require a significant level of expertise and professional abilities, which is a derivative of reports complexity.

However, the mentioned analysis has one major setback (even when conducted flawlessly). It may only produce conclusions about a company's performance (actual and expected). **It cannot assess the ability of <u>other</u> investors to reach the same conclusions and extract the same insights, nor assess their aggregate response over time**. According to the Efficient Market Hypothesis, the semi-strong efficiency is such that "at any given time, prices fully reflect all publicly available information on a particular stock". Meaning, not only prices already reflect all public information, they incorporate any expected (future) changes as well.

Nevertheless, stock prices change due to demand of investors, so a **stock price is not comprised of intrinsic performance attributes of a company, but from investors' subjective attitudes towards its future state**. Therefore, value does not reside only in making accurate assessments of future company's performance, but there is additional value encompassed in detection (in advance) whether other investors will reach and follow the same direction and magnitude of assessments. When accurate assessments are made by a minority of investors, and inaccurate assessments are made by a majority of investors, the first may obtain gains on the expense of the majority's losses.

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Therefore, it may be argued that the ability of a single investor to make estimations of (other) investors' assessments of company's performance is important just as estimating the company's performance. **Put simply, trying to estimate stock price changes should incorporate other investors' estimations, and for doing so – it must assess the way that investors interpret data (in this case, information residing in the annual report) and its future implications.**

Following this notion, not only should investors scrutinize annual reports for valuable insights about a company, they should also assess the degree of interpretation of other investors to the same data – how will other investors react when exposed to the same information.

The findings of this study offer means for assessing aggregate investor interpretation abilities as reflected in their reactions, by supplying a proprietary measurement framework of (Form 10-K) intricacy and load.

In turn, measures of intricacy and load may be translated to a combined measure of requirements, made from investors to extract information from the reports. These requirements are made of both data digestion capabilities, and load handling capacity. Having benchmarked said requirements against NASDAQ figures over the 2005-2015 decade, it is possible to use the impact related findings of this study in order to predict short and long-term movements of performance/volume figures which are derivatives of the Form 10-K impact over investors.

7.2 CORROBORATION OF PREVIOUS RESEARCH

7.2.1   Auditor and audit-tier related results

Auditor related evidence in previous studies: first-tier auditors are mentioned throughout the literature as showing unique characteristics when compared to non-first tier auditors. Mentioned differences are in favor of the first-tier auditors, indicating that investors should have consequently more trust in information provided by them. Several examples for these differences in literature: firms audited by a first-tier auditor are more likely to adhere to regulations [Dalton et al., 2010]. They are also more likely to provide more timely filings [Schwartz and Soo, 1996b], and are more reliable and credible as seen by investors [Beatty, 1989; Davidson and Neu, 1993]. Some of the studies relate to possible reasons for this to happen, and mention that Auditor size is fundamentally tied with auditor independence [Watts and Zimmerman, 1983], and with extensive scrutiny and restraint of customers [Weiner, 2012]. In addition, there are studies relating said differences motivational reasons, for example, that first-tier auditors with more reputation are incentivized to conduct better quality audits [DeAngelo, 1981a; Weiner, 2012] and that larger financial wealth of auditors, leading to increased amount of risk and lawsuits vulnerability also act as incentivizers for quality audits [Dye, 1993; Weiner, 2012]. Finally, these differences are also said to exist not just for different incentives and efforts, but also due to different capacity, as reflected in McLennan and Park, [2016] findings that first-tier auditors have operational advantages due to their size.

Auditor related evidence in the current study: evidence presented in this study indicate that audit-tier is a direct component in market reactions (thus, in Form 10-K impact) only when relating to volume-related changes. When relating to performance and its volatility, the audit-tier proves as an insignificant predictor (see section 6.8). The impact of audit-tier found in this study is only indirect, caused by significantly different requirements (from load and intricacy perspectives) reflecting in Form 10-K reports audited by a first-tier auditor, which only in turn influence investors reactions. Put simply, investors only react with a secondary effect to the audit-tier (which is caused by different attributes, both

external and intrinsic), and do not differ when measuring their direct response to different audit-tiers.

There are several possible reasons for this phenomenon to occur, which may co-exist: first of all, it may be argued that audit-tier is already reflected and impounded at the stock price, and therefore will not reflect in different post-publication values. Secondly, as mentioned in section 2.2.4, a certain degree of reputation loss was registered to first-tier auditors following the 2008 financial crises and the Anderson-Enron case, which may reduce the extent of differences in investor reactions to audit-tiers. Finally, since inter-office differences exist among the first-tier auditors themselves (as mentioned in section 2.2.3, large and small offices of the same auditors do not share the same capacity or skills), they may also mitigate this phenomenon by blurring the gap between tiers, as seen by investors.

Inter-office differences of audit-tiers: there are two studies mentioned in the literature review which deal specifically with inter-office differences among the first-tier group: Vera-munoz et al. [2006], which found "practical limits to knowledge-sharing practices that make it very difficult for large accounting firms to fully capture the expertise of office-based professions", and Francis et al. [2013], indicating that larger offices' clients have less ex-post restatements. This study provides supportive evidence to confirm that the range (dispersity) of differences in Form 10-K attributes is larger among first-tier auditors.

Results of data analysis (see section 12.2) indicate that **the standard deviations of readability indices, as well as the word count are larger among the first-tier auditors**, hence, confirming previous indications that expertise and knowledge sharing can only be reached to an extent, and that although producing more intricate reports (see section 6.4), the first-tier auditors are also showing larger dispersion of values than their non-first tier counterparts.

To conclude, this study confirms evidence found in existing literature regarding the different effects of first-audit tier. It does so by adding a limitation in which the only direct effect is on trade volume, while performance-related effects are expressed via an

indirect effect, which is the outcome of audit-tier impact on Form 10-K attributes (which in turn are the ones causing the effect mentioned).

In addition, this study confirms evidence found in existing literature regarding the inter-office differences of the first audit tier. It does so by showing that said differences are larger within the first-tier, and manifest themselves in readability and complexity attributes (hence related to the intricacy measure of reports).

7.2.2   Readability and informativeness related results

Specific attention in literature was attributed to readability measures of financial reports. As pointed by Li et al. [2006], readability may come to larger importance, and have larger effects when dealing with particular types of firms, since higher information asymmetry lies in high growth industries, where future returns are uncertain. In these cases, the readability of the reports themselves may have a significant influence on investors' success to differentiate firms and manage to digest information residing in the reports in order to make decisions. Research by Loughran et al. [2009] indicate that this phenomenon is especially significant within small investors groups, which when facing reports with lower digestion requirements (hence, better readability) tend to expand trading volumes.

However, as evidence presented in this study show, readability measurements may be biased. The Gunning Fog readability index proved statistically insignificant in several tests made throughout this study (for example, FOG annual means by auditor group, see Figure 22: fog annual means by auditor group), while the ARI and Flesch-Kincaid show significant results. Since the FOG index may get skewed by the use of jargon words [Doyle and Magilke, 2012]. This may be attributed to the fact that business texts are using long complex words to describe very common practices, like the phrases "corporation", "executive" and "directors", which although containing many syllables are natural and easy for comprehension by most investors. An example is set by Loughran et al. [2009], which is referring to the word "telecommunications" as a sample for the inaccuracy of relating for syllables as a proxy for complexity, indicating a multi-syllable word of a very common phrase.

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As mentioned in the literature review, a Model built by You and Zhang [2009] document price changes of stocks in relation to news publications, while making a distinction between "good" and "bad" news. As indicated, bad news cause a downward drift, and good news cause the opposite. You and Zhang [2009] indicated that good news usually reside in reports in the form of figures, thus tending to be quantitative, while bad news are usually described in words, thus qualitative. This study does not make a distinction between good and bad words in the Form 10-K content. However, there are two relevant variables which do get measured and make be used to corroborate You and Zhang [2009] results. The first is the narrative value variable – describing the ratio between words and figures, this variable actually indicates the qualitative/quantitative ratio of each report. Since (as indicated) good news produce opposite impact of bad news, the narrative ratio can be measured against the long-term performance, to see whether the same results is produced. Indeed, data presented (see section 6.8) show that narrative ration does act as a significant negative predictor of long-term performance. This finding corroborates the same impact described by You and Zhang [2009]: when the narrative ratio is larger, the reports have more words (hence, more qualitative), and accordingly the performance figures reduce. The opposite situation appears when narrative ration reduces, meaning the reports in more quantitative, and accordingly the performance figures measured are larger.

As mentioned in the literature review, Choudhary et al. [2014] indicate that early filings are on average less informative when compared against filings made on time, and suggest that this is caused by either lower readability of the filings (longs sentences, complex, multi-syllable words), less revision and elaboration due to the expedited process, preemption by other voluntary information disclosure events. However, data in this study find that this direct connection (early presentation versus lack of informativeness) is rather an outcome of load requirements reports present to investors (hence, an indirect effect), and not an outcome of a link between early presentation and lack of informativeness. There is a significant and positive connection between the peak proximity and investor reactions (see section 6.8), in which peak proximity acts as a significant and positive predictor of short-term performance and its volatility. It should be noted that although the relation

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between the peak proximity and the readability indices suggested is confirmed, it is also found to be mitigated in great extent by the opposite influence, related to the load requirements reduction observed in larger distance from the presentation peaks (see section 6.6.1).

To conclude, this study is corroborating previous data presented in You and Zhang [2009] and Choudhary et al. [2014], in which performance is tied with qualitative/quantitative ratios, and peak proximity is tied indirectly with performance, via information digestion requirements.

In a critical perspective, although the significance and direction are both confirmed, it may only describe a circumstantial corroboration, since the correlations found does not necessarily indicate causality (does not act as confirmation for the phenomenon origins).

7.3 LIMITATIONS AND RESERVATIONS

Sampling related bias: data for this study is sampled via NASDAQ, between the years 2005-2015. Type of information gathered is annual Form 10-K reports in a standard U.S. Securities and Exchange Commission Form 10-K format. The NASDAQ stock exchange has unique characteristics - it holds significant reach in a broad range of industry sectors, while maintaining high listing standards [Thompson, 2003]. In addition, NASDAQ is serving a global platform for capital formation on a global scale[64].

It may be argued that such supportive data environment may be somewhat missing on other worldwide stock exchanges, and therefore the data presented in this study may consequently be biased as a result, having heterogenic investors/firms mix among

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[64] NASDAQ has more listed companies (approximately 3,300 on August 2015), trades more volume (approximately 2 billion shares daily) and handles more IPOs (over 1,044 since 2000) than any other U.S. exchange. In a recent update of a multi-year study of investors the following statistics were published: "NASDAQ is the most widely-recognized stock market, with greater brand recognition than any other U.S. exchange. Until 2007, NASDAQ has earned over two-thirds of the IPOs eligible to list on NASDAQ or the NYSE Group, including 20 non-U.S. companies, raising a combined $15.99 Billion". Retrieved from nasdaq.com/reference/market_facts

exchanges. For example, such bias can be an outcome of NASDAQ attracting abnormally large segments of data savvy investors, which in turn cause different investors mix than in other exchanges.

Therefore, results presented may prove unique to NASDAQ and will not generalize well over other stock exchanges, which may be bearing different attributes or different investors/firm mix, have lesser global scale or less supportive data environment.

Critical evaluation: this study evaluates information digesting requirements in relation with Form 10-K reports. However, these reports are not the sole source of information for investors. There are additional sources, whether formal as press releases and earning announcements or informal as news and analysts reviews, which may contain valuable information upon which educated decision making can be made. Such information may reduce significantly the extent of resources required for information digesting, especially when relating to analysts reviews which mark specific stocks withhold, buy and sell recommendations. In these cases, it may be argued that investors may not depend on their intrinsic information digestion capabilities (but rather feed on pre-digested information supplied by analysts), so the impact of load and intricacy aspects as a derivative of reports will reduce accordingly. However, relying on un-audited sources of information has its own setbacks, which in turn may also limit investor abilities to obtain trustworthy information.

An additional aspect which may come to larger importance in the future is the use of automated algorithms for information digesting processes. Such systems may assist investors, especially small investors with smaller information gathering capacities, and support them in coping with both load and intricacy of reports.

7.4 RECOMMENDATIONS FOR FUTURE RESEARCH

There are several verticals in which future research may be implemented:

The first and immediate vertical is extending the time frames which market reactions are measured, to search for an optimal time-frame. This study uses 3 and 21 day time frames of aggregated figures as an arbitrary selection based on previous studies, as well as a 28-day ranking time frame. It may be justly argued that these time frames are not optimal, and that impacts on multiple day combinations should be examined in order to locate an optimal time frame (which more significantly reflect differences and attribute impact). Needless to say, there is no reason to believe that performance and volume impacts share the exact time frame, and it may be realized that different optimal time frames exist for them both.

The second vertical relate to extending the text analysis further to answer for the use of jargon words. An mentioned in section 7.2.2, the Gunning Fog readability index proved statistically insignificant in several tests made throughout this study, while the ARI and Flesch-Kincaid show significant results. A preliminary process of detecting jargon words and excluding them may yield better results for this index. In addition, it may prove beneficial to conduct a sentiment based analysis, as done in Miller and Gregory, [2002], in order to further detect relations between variables which derive from of the choice of words and sentiment of the reports, thus adding a dimension to the current analysis which relate just for readability and complexity measures.

The third vertical relate to expanding the granularity of the data. Making additional distinctions between small and large offices of the same auditor, between small and large investors, and between auditor-switching and auditor-loyal firms may produce results with larger resolution and point the differences to a particular population or cause.

Finally, an industry based segmentation may also yield significant results and provide better resolution of trends described. Since certain industries may prove more volatility or more vulnerable in times of crises, it may be argued that controlling inter-industry variability in impact based analysis may prove significant.

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11. TERMS

The following terms are used within this study, appearing hereby in alphabetical order:

***AUDITOR-TIERS*:** The largest four audit firms are also referred to in this study as "first-tier auditors", or by their familiar nickname "the Big 4". Members of this group are Ernst and Young (E&Y), Price Waterhouse Coopers (PWC), Deloitte Touche Tohmatsu (Deloitte) and Klynveld Peat Marwick Goerdeler (KPMG). The "Big 4" auditors group is known[65] for its market dominance, especially among large public firms. These auditors offer international professional services networks (including audit, tax services and consultancy). With a figure of 162-210 thousand employees and a revenue of 25-35 Billion dollars as of 2014[66], this first-tier audit group may be claimed to be an actual oligopoly in the audit of large firms. This study refers to different auditors in respect for their membership in this group, thus, being a "first-tier" auditor or "non-first-tier" auditor (and in accordance, part of the "Big 4", and not a part of the "Big 4").

DEADLINE, DEADLINE ACCELERATION: Revised deadlines for periodic reports by SEC state[67] that non-accelerated filers (having less than $75M public float) are to issue Form 10-K reports within 90 days from the fiscal year start. Accelerated filers (having less $75M-$700M public float) are to issue Form 10-K reports within 75 days span. Large accelerated filers (having more than $700M public float) are to issue Form 10-K reports within 60 days span. As the legislative authority in charge of regulated disclosures made

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[65] The Big Four Firms Financial Performance Analysis, 2014, Big4.com.

[66] Retrieved from Big4.com, a global social network for Big Four alumni and professionals, available at www.big4.com/analysis.

[67] Securities and Exchange Commission, 17 CFR PARTS 210, 229, 240 and 249, RELEASE NOS. 33-8128; 34-46464; FR-63; File No. S7-08-02, RIN 3235-AI33: Acceleration of Periodic Report Filing Dates and Disclosure Concerning Website Access to Reports.

at the stock exchanges, SEC enforces the decisions encapsulated at filings related acts[68]. Although the distinction between quarterly reports and yearly reports has existed before 2002 (due in 35 days and 90 days, accordingly), the distinction based on market share has only been active since 2002, when SEC shortened Form 10-K deadlines to 60 days for larger firms[69]. The market capitalization threshold determined to distinguish accelerated fliers and non-accelerated fliers have been set on $75M. The split of the accelerated firm population was further carried on by the implementation of the 2005 SEC decision to make another distinction for a "large accelerated filer", which have $700M and more public float, thus creating three levels of acceleration within the market (filing at 90, 75 and 60 days).

EDGAR: "Electronic Data Gathering, Analysis, and Retrieval" - A proprietary information system SEC operates for tasks of documents (statements, reports or announcements) transmission and retrieval. This system includes a free database, available online, and a user interface allowing queries, searches and download of stock exchange related data. Excessing 3000 filings per day[70], this database forms an automated system for SEC related filings. Firms were phased (via mandatory electronic filing) into EDGAR in a three years process, in the years 1993-1995. Foreign firms made the mentioned phase by 2002.

FILING/PUBLICATION EVENT: SEC regulations determine publication filing as one being presented on a regular weekday (excluding Saturday, Sunday and holiday). After the filing has passed the acceptance review and the filing fee has been taken care of in full, the

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[68] Retrieved from "Current SEC Commissioners", Sec.gov, December 17, 2012.

[69] "How the SEC Protects Investors, Maintains Market Integrity, and Facilitates Capital Formation", Securities and Exchange Commission, Sec.gov. March 1, 2013.

[70] "Filing Review Process", Sec.gov. October 16, 2015.

filing is fed into the information system, which makes it available for public domain after 24 hours from the filing event[71].

FORM 10-K: SEC designated form for audited annual financial reports. This form includes audited financial statements, as well as equity, subsidiaries and organizational information. A form 10-K consists of four main parts[72]: The first part contains a description of the business, risk factors, unresolved staff comments, description of properties, legal proceedings and safety disclosures. The second part contains information regarding market for registrant's common equity, related stockholder matters and issuer purchases of equity securities, selected financial data, management's discussion and analysis of financial condition and results of operations, quantitative and qualitative disclosures about market risk, financial statements and supplementary data, changes in and disagreements with accountants on accounting and financial disclosure, controls and procedures and other information. The third part contains information about directors, executive officers and corporate governance, executive compensation, security ownership of certain beneficial owners and management and related stockholder matters, certain relationships and related transactions, and director independence, principal accounting fees and services. Finally, the fourth part contain exhibits, financial statement schedules signatures. Annual audited financial statements regulated by the US securities and exchanges commission are referred to in this study as "annual Form 10-K reports", and in a shortened version as one of the following (in relation to the specific content): reports, filings, transmissions or publications. This naming convention is applied in order to differentiate Form 10-K reports from other types of financial statements and annual reports (as shareholders reports) which are not audited or mandatory by regulation.

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[71] Securities and Exchange Commission, Forms and filing instructions, Edgar.sec.gov, May 16, 2014.

[72] Form 10-K General Instructions, SEC.gov, available at http://www.sec.gov/about/forms/form10-k.pdf.

FORM 10-K ATTRIBUTES: This study makes a distinction between two types of attribute groups within the Form 10-K. The first, intrinsic attributes, depend only on the Form 10-K report itself, and doesn't relate to external events. The intrinsic attributes are parameters calculated from the text of the report, and act as Meta-data on top of the content, describing complexity and readability of the text for readers. Such attributes are deriving from the narrative characteristics of the report. The second type of attributes are external attributes, which are not intrinsic but rather exist within a particular context, deriving from different parties as regulatory authorities, other firms and auditors (for example, publication load concurrency and peak publication proximity). These attributes derive from circumstantial events (such as concurrency of publications made by other firms), or from deliberate decisions made regarding the auditing firm or the specific publication date and its proximity to the regulated deadline. See additional elaboration in section 5.5.1 for attribute processing techniques.

FORM 10-Q: SEC proprietary form for quarterly reports. This type of report is presented three times per year (annual report covers the last quarter). In addition for new information disclosures, Form 10-Q reports contain a comparison of the last quarter to the current one, as well as a comparison for the last year's quarter. Financial statements made within these reports are usually not audited[73].

FORM NT 10-K: A proprietary form which should be issued whenever a firm is unable to file the Form 10-K in time[74]. The firm then receives an automatic extension of 15 days to complete the original filing. It should be noted that the NT filings can only result in a one-time grace period, and cannot be re-used for the same filing. While the grace period is set

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[73] SEC Financial Reporting Manual, Division of Corporation Finance, Section 2410.8, Topic 11.

[74] "Filing Review Process". SEC.gov. October 16, 2015.

at five days for quarterly (10-Q) filings, it allows 15 additional days in case of a 10-K annual filing.

INFORMATION FLOW: Firms hold a broad communication network with external entities (investors, prospect investors, regulatory and law compliance agents). The overall objective of the mentioned network is to allow fair valuation for the firm's securities, and to enable accurate disclosure of the firm's state[75]. The importance of delivering accurate information, as well as the importance of investor relations, was enforced through the Sarbanes-Oxley Act of 2002, which set new standards and requirements for information flow, both from regulatory and corporate governance aspects (with emphasis given to the accuracy of financial reports, and to improving corporate compliance to regulation). The mentioned information is channeled to investors via several sources. Unofficial sources as news, analysts' reviews and other types of media may offer investors not just information but also recommendations and predictions. Direct sources offer information that is first hand: quarterly and annual filings, earnings announcements and press releases are all samples of direct firm-investor information flow.

INVESTOR, INVESTOR TYPES: Any person or establishment which allocates capital with expectation for future returns (of any sort) may be referred to as an investor. Institutional investors such as private equity funds aggregate collectives of investors to perform capital allocations[76]. Mutual funds and hedge funds address individual investors too, offering an investment collective within a specific legal frame, as an LLC or limited partnership. The distinction between small and large investors is further adopted by the US Securities and Exchange Commission, which direct several acts (for example, the Plain English initiative) to assist specifically small investors.

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[75] Retrieved from "Current SEC Commissioners", Sec.gov, December 17, 2012.

[76] "Looking at Corporate Governance from the Investor's Perspective", Sec.gov. April 21, 2014.

MARKET CAP: Representing the total market value of a specific firm. Calculated by multiplying the number of outstanding stocks by a single share value.

PUBLIC FLOAT: Representing the part of the firm's shares which resides at the hands of the public, which are freely tradable, and are not locked-in by firm officers or controlling investors.

SEC: The US Securities and Exchange Commission is a government commission established by the US Congress, whose main objective is protecting investors by regulating securities markets. SEC is defined as a federal agency, and is responsible for both regulation and enforcement. SEC promotes public disclosure of information by firms, and act to prevent any manipulative or fraudulent practices which may damage quality or integrity of the mentioned disclosures[77]. SEC regulations are comprised of several different acts: they include the securities act, the trust indenture act, the securities exchange act and the investment company act. SEC is considered to be the primary securities regulator on the federal level[78]. Being an agency of the federal government, it holds primary responsibility for making sure the securities laws made by the federal administration are properly enforced, through proposing new rules and adjusting existing ones.

STOCK EXCHANGE FRAMEWORK*:* A market is defined as a place whereby parties engage in exchange[79]. The stock market is no different, since it acts as a platform, enabling sellers and buyers to exchange stocks and equity. It may be argued that the Stock market is a representative example of a complex market: it is an effervescent framework, reaching out many aspects of the modern economy - from news correspondents to analysts, through

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[77] Retrieved from "A-Z Index of U.S. Government Departments and Agencies", https://www.usa.gov/branches-of-government.

[78] "How the SEC Protects Investors, Maintains Market Integrity, and Facilitates Capital Formation", Securities and Exchange Commission, Sec.gov. March 1, 2013.

[79] Oxford Dictionaries, Retrieved 25 October 2014.

regulators, legislators, small investors and wealth management establishments, all have a part, interest and a role within this environment. The Stock Exchange offers capital raising for expanding and initial public offering (IPO), while supporting the daily capital trade of shares and bonds. The world's largest exchange, in terms of both market cap and volume is the New York Stock Exchange, which has the same market cap as the following three exchanges (NASDAQ, LSE, JPX) combined[80], reaching almost $20T. When viewing monthly trade volumes NYSE still has the lead, with SSE (Shanghai Stock Exchange) and NASDAQ following ($1520, $1278 and $1183 BN accordingly).

TEXT READABILITY INDICES: The text readability attributes consist of three readability indices which are the Gunning Fog index, the Automatic Readability index and the Flesch-Kincaid index. These readability indices are used for evaluating the readability of English text. The readability is measured on the extent in which a person can understand the text in the first read, while estimating as an outcome parameters as the number of education years (Gunning-Fog), or grade level (ARI, Flesch-Kincaid) required from the reader. These indices are in the shape of an interval scale, and follow a negative relation between text readability and index score, thus, the larger a readability score index is, the less easy it is for reading (hence, requiring larger education level from the reader).

All three techniques use calculation of ratios between different measures of text, as the ratio between words and sentences, between complex and simple words, and additional measures of complexity as character and syllable count.

The Gunning Fog index is based on the ratio between syllables and words, labeling a word as complex when having three or more syllables. This index also uses words to sentences ratio for estimating an average sentence length in words.

The Automated Readability Index (ARI) is based on the ratio between characters and words, estimating word complexity by the average number of characters per word. Similar

[80] Retrieved from World Federation of Exchanges, 31 January 2015 Monthly report.

to the Gunning Fog index, this index also uses words to sentences ratio for estimating an average sentence length in words.

The Flesch-Kincaid readability index is divided into two separate tests of estimation, which are the reading ease estimation test, and the grade level estimation test which is used in this study. This index is based on calculating the overall ratio of words and sentences in a document (the average count of words in a sentence) and combining it to the level of complexity when measuring the total number of syllables relating to the total number of words, hence getting the average number of syllables per word. It is different than the Automatic readability index by giving notice to syllables instead of characters when determining the amount of complexity a word presents for a reader. In addition, it is different than the Gunning Fog index by not setting a fixed syllable limit (3 syllables) for complex words, but rather use a relative figure (which is the average syllables per word).

THE PLAIN ENGLISH ACT: Effective since October 1998[81], rule 421 issued by SEC requires all firms' publications to answer for "substantial compliance" of writing principals referred to as "Plain English". Among these principals, use of short sentences, everyday language, use of active voice while avoiding legal jargon and non-active voice. The goal of the "Plain English" act is having all of the filings, publications and disclosures made by firms to answer the Plain English measure (SEC release #34-38164, p. 24).

TRADE VOLUME: Indicating the amount of shares which were traded within a specific period of time. This study also refers to this term in short as "volume". It should be noted that the unit of measurement for volume is shares per unit of time. Since different stocks trade in different prices per share, trade volume cannot be compared in terms of actual spend/currency, but rather should be relative (for past figures).

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[81] Plain Writing Act, Public Law No: 111-274, (introduced 2/10) H.R.946.

12. APPENDIX

## 12.1 YEAR 2008 CRISES EFFECT ON MEASUREMENTS IN THIS STUDY

The 2008 global economic crises[82] impact is visible within data presented in this study. Reports published in 2009, several months after the crises peak on October 2008, show (as presented in figures 31,32,33) a difference in investors' behavior, having larger performance volatility accompanied with smaller volume volatility. It should be noted that the impact of the crises on measurements within this study is quite considerable with direct relation to the magnitude the crises impact, believed by several to be the most intense crises experienced by the US economy since the "Great Depression"[83]. The crises effect is visible to a milder extent within the 2008 Form 10-K reports impact analysis results. The crisis impact manifest itself especially in the extent of performance, showing spans which are double in the extent of all four percentiles of performance attributes. As an after-effect, the larger performance figures lead to larger volatility figures (see figure 31). In order to mitigate the crises effects, volatility historical scope in this study is limited to figures measured during the time span starting at the fiscal year start (which the report is referring to), and ending the day prior to the publication. This allows volatility calculations made

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[82] The 2008 global economic crises, also referred to as "the global financial crises", was an outcome of the subprime crises started on July 2007 at the US, and spread afterwards to different parts of the world. Prior to the crisis, a low interest policy set by the Federal Reserve used as a catalyst for a boosting economy. Said years presented a massive uptrend in household/personal consumption, and an incline in real estate prices. Questions regarding the ability of households to adequately pay their debts, especially mortgage related debts started to arise when significant numbers of people did not keep their loan payments. By July 2007, mortgage based bonds started dropping. Collateralized debt obligations were traded by investment firms by demand, and were purchased in great extent by banks and other financial institutes throughout the world. The drops in bonds caused significant damages for purchasing institutes, and as an after effect, for a severe shortage of finance. When Lehman Brothers investment bank went bankrupt in 16 of September 2008, extreme measures had to be taken by governments in order to stop other institutes to follow (including AIG, the largest insurance firm in the world, requiring a bail out from the Federal government).

[83] Reuters. 27 February 2009, available at www.reuters.com/article/idUS193520+27-Feb-2009+BW20090227.

post-2010 to be bias-free from previous historical (older than one year) measurements which may be abnormally different in scale and dispersion.

An additional illustration of the 2008 crises is illustrated in the following figure, comparing performance volatility averages of aggregated 21 days post-publication. As demonstrated, the effect of Form 10-K publication on performance was the highest following the 2008 crises (measured after reports published on 2009 first quarter).

FIGURE 31: LONG-TERM PERFORMACE VOLATILITY ANNUAL MEANS
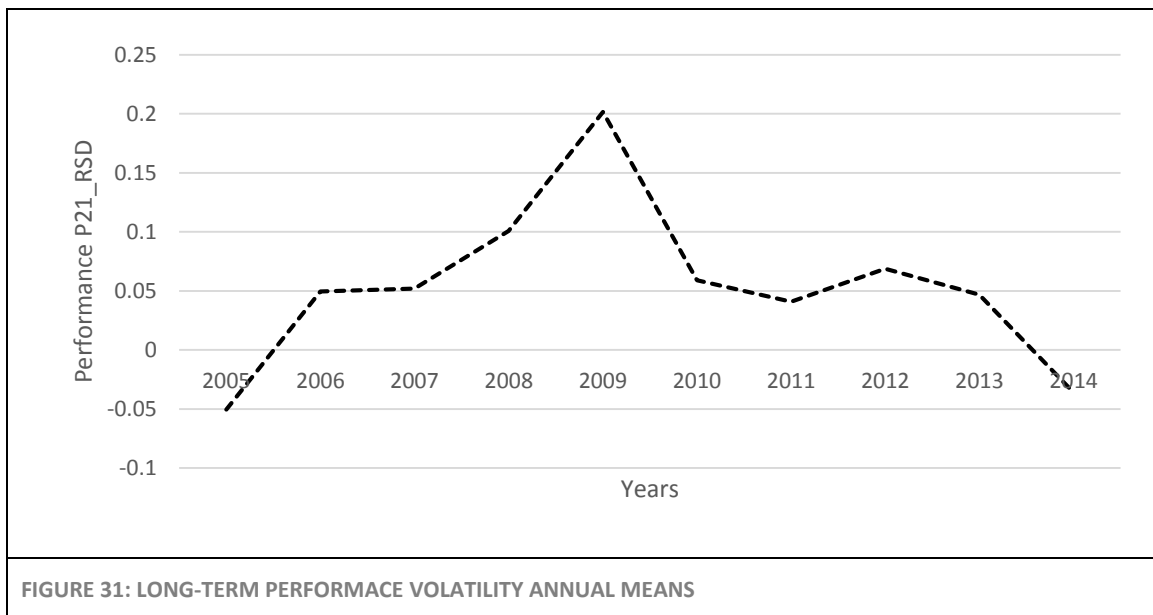
As illustrated in figure 32, volume volatility show that the lowest values were measured at 2009, indicating that reports publication caused abnormalities not just in performance but also in volume, in opposite directions – while crisis measured impact is positively high on performance volatility, it has a strong negative impact on volume volatility.

FIGURE 32:VOLUME VOLATILITY ANNUAL MEANS
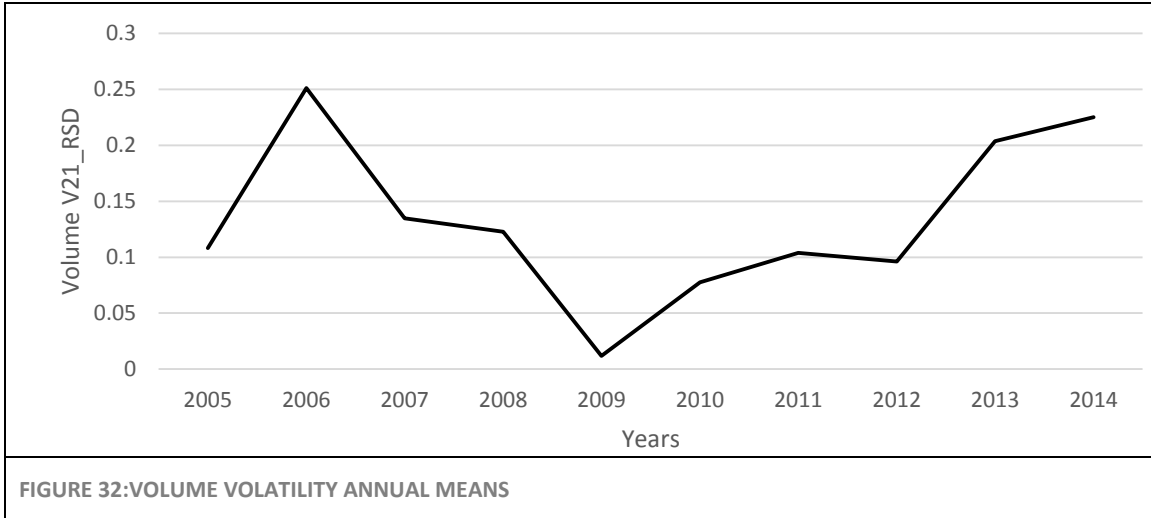
Finally, short-term performance also show values with larger distribution in 2009 crises period, as illustrated in figure 33:

FIGURE 33: SHORT-TERM PERFORMANCE ANNUAL BOXPLOT

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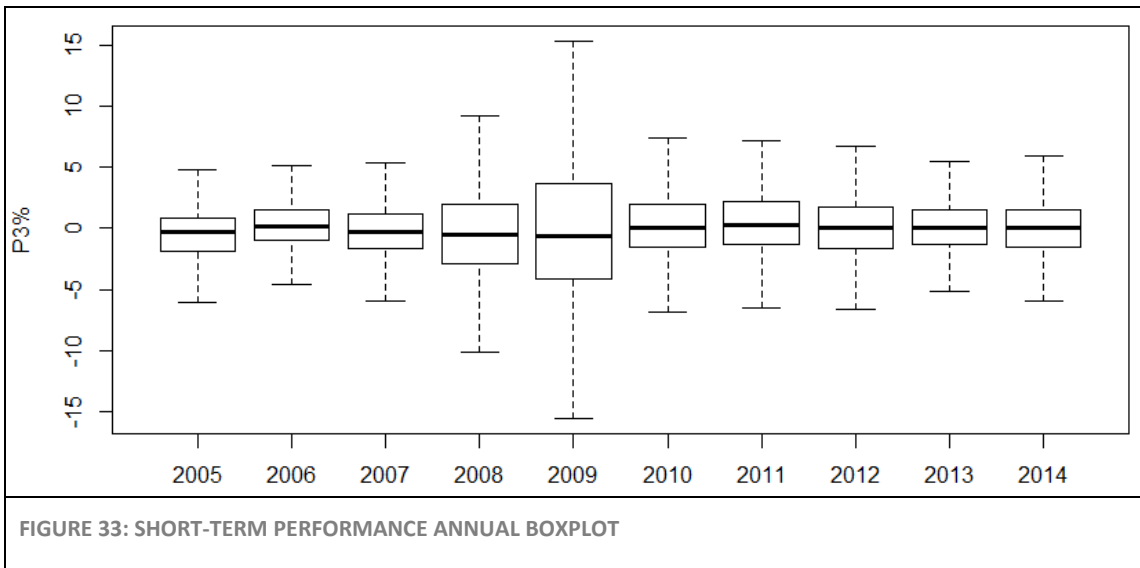
12.2 FORM 10-K ATTRIBUTES HISTOGRAMS AND BOXPLOTS

TABLE 44: FOG DESCRIPTIVES

Measure	Overall	Non-First-Tier	First-Tier
N (count)	7618	3236	4382
Mean	16.59	16.60	16.58
Median	16.59	16.55	16.63
Minimum	13.03	13.31	13.03
Maximum	20.24	20.09	20.24
Standard deviation	1.07	1.04	1.10
Distribution	Kurtosis=0.29, Skewness=-0.01		
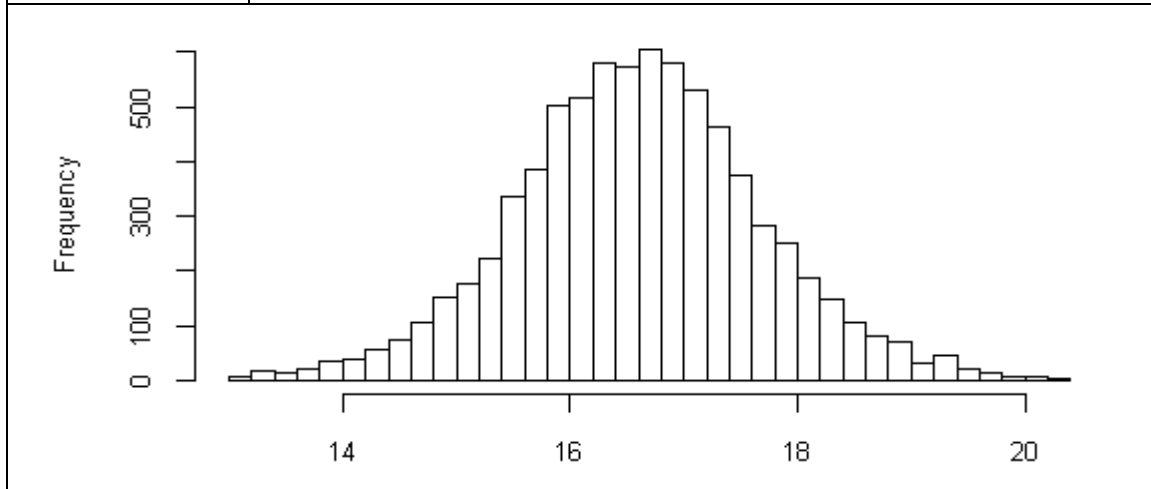
FIGURE 34: FOG VALUES HISTOGRAM
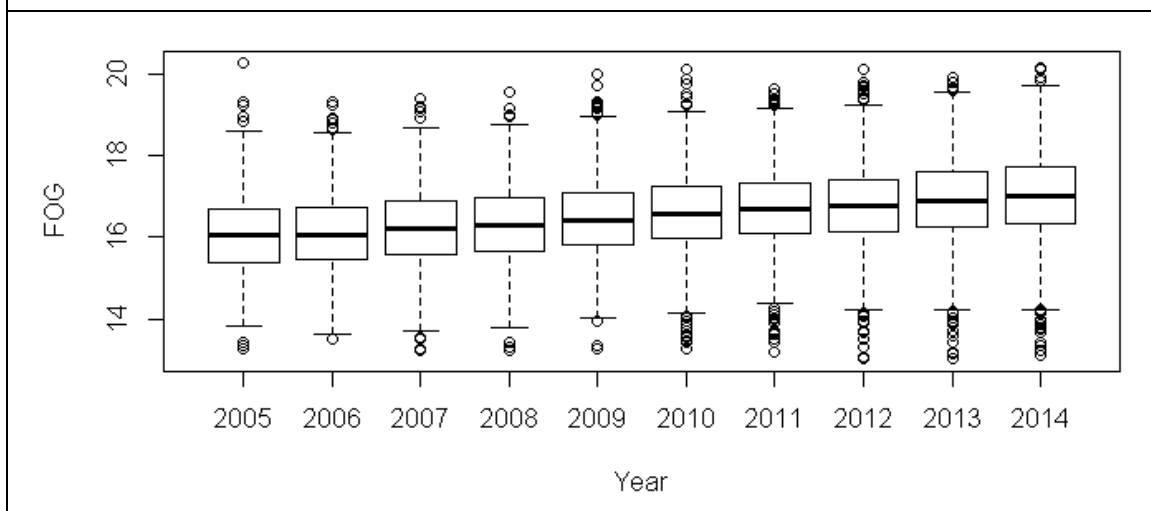
FIGURE 35: FOG VALUES BOXPLOT

TABLE 45: ARI DESCRIPTIVES

Measure	Overall	Non-First-Tier	First-Tier
N (count)	7618	3236	4382
Mean	14.04	13.94	14.11
Median	14.03	13.87	14.15
Minimum	10.04	10.25	10.04
Maximum	18.11	18.04	18.11
Standard deviation	1.22	1.15	1.27
Distribution	Kurtosis=0.17, Skewness=0.003		
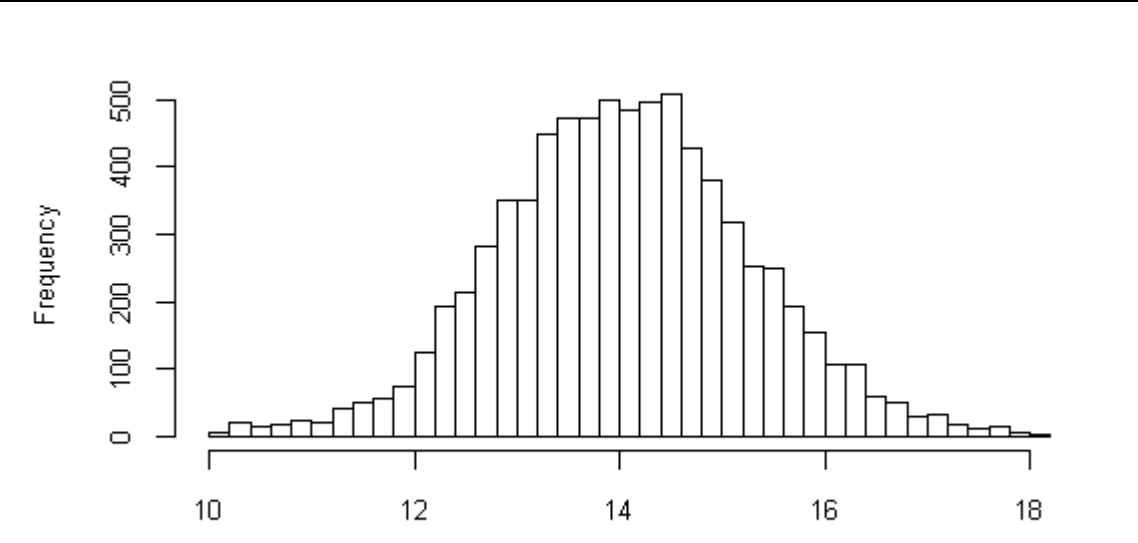
FIGURE 36: ARI VALUES HISTOGRAM
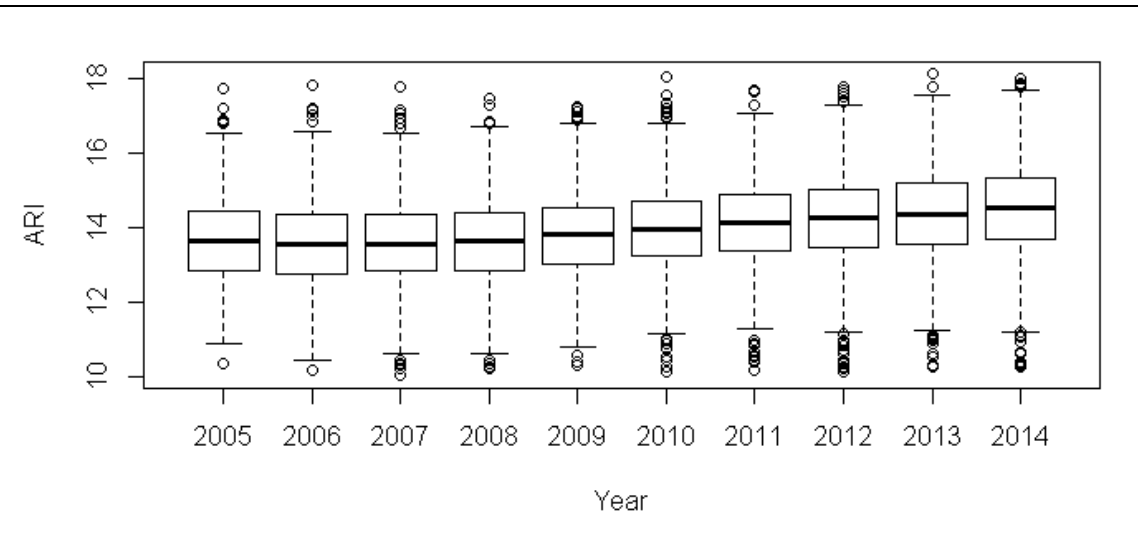
FIGURE 37: ARI VALUES BOXPLOT

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Measure	Overall	Non-First-Tier	First-Tier
N (count)	7618	3236	4382
Mean	8.73	8.68	8.77
Median	8.73	8.65	8.80
Minimum	5.34	5.34	5.35
Maximum	12.01	11.81	12.01
Standard deviation	0.99	0.93	1.03
Distribution	Kurtosis=0.43, Skewness=-0.08		
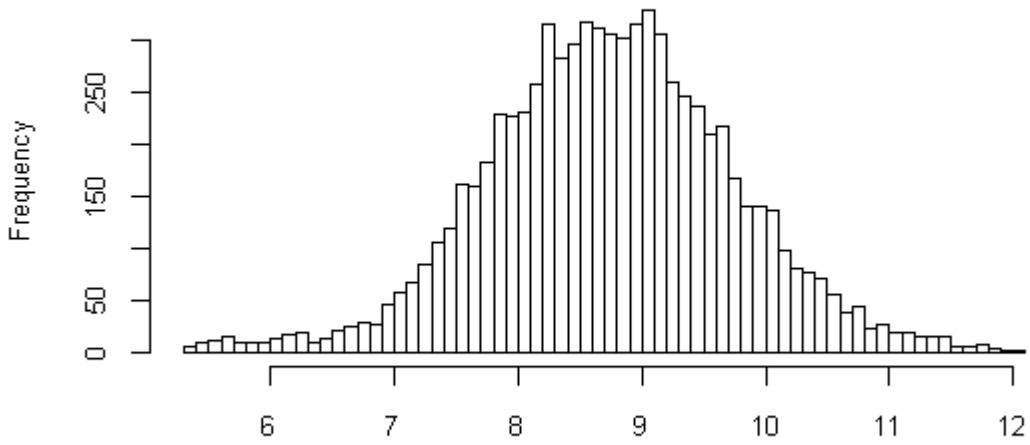
FIGURE 38: FK VALUES HISTOGRAM
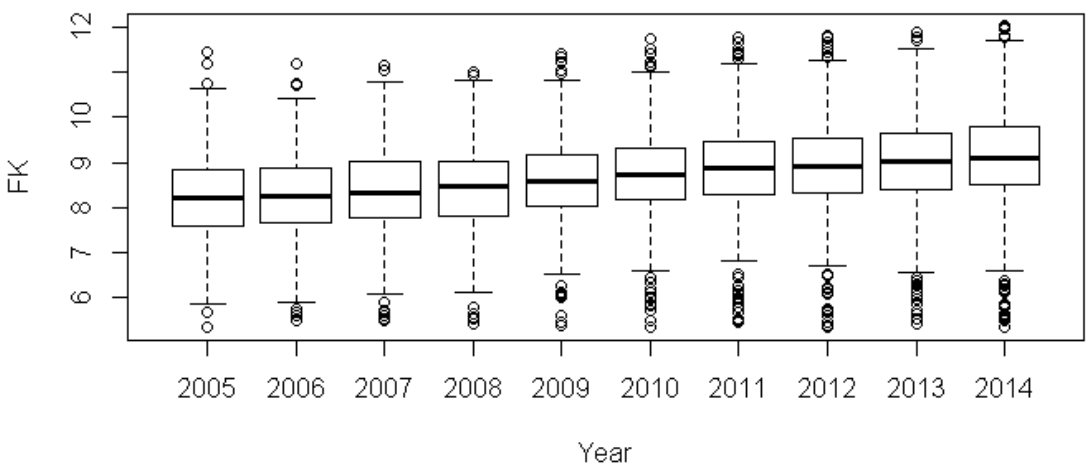
FIGURE 39: FK VALUES BOXPLOT

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Measure	Overall	Non-First-Tier	First-Tier
N (count)	7618	3236	4382
Mean	62629.48	55434.37	67942.89
Median	52948.50	47984.00	57481.00
Minimum	12149	12149	12975
Maximum	199394	197878	199394
Standard deviation	33195.74	30739.63	33936.50
Distribution	Kurtosis=1.47, Skewness=1.307		

TABLE 47: WORD COUNT DESCRIPTIVES
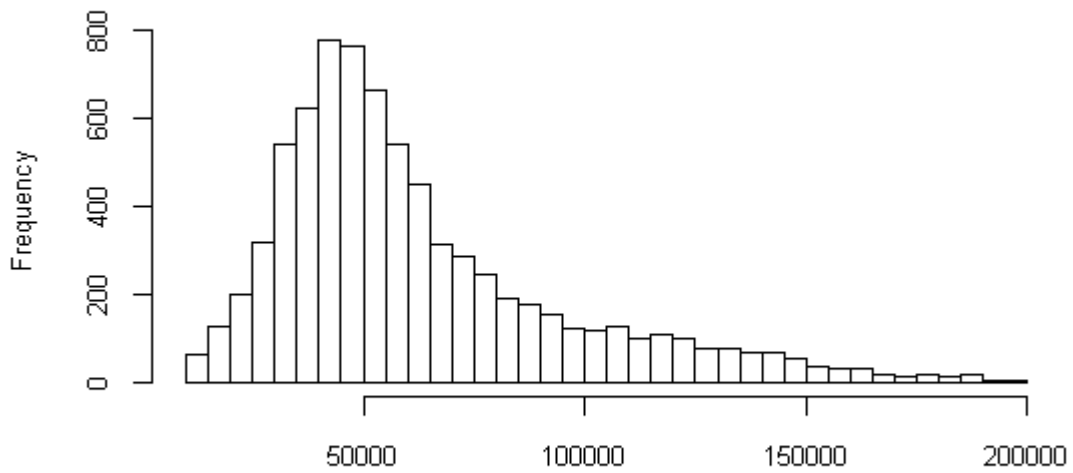
FIGURE 40: WORD COUNT VALUES HISTOGRAM
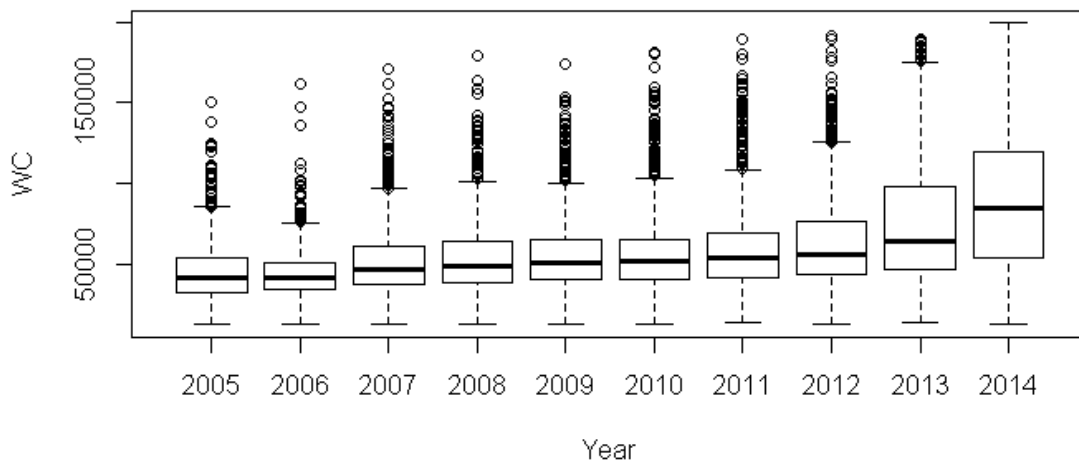
FIGURE 41: WORD COUNT VALUES BOXPLOT

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TABLE 48: NARRATIVE RATIO DESCRIPTIVES

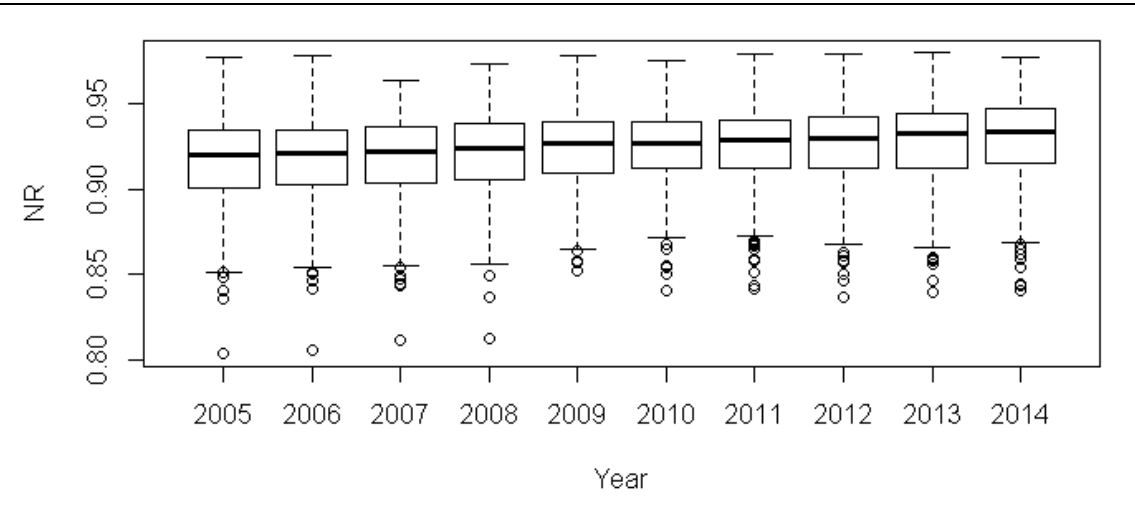| Measure	Overall	Non-First-Tier	First-Tier
N (count)	7618	3236	4382
Mean	0.923	0.917	0.928
Median	0.927	0.919	0.932
Minimum	0.803	0.803	0.836
Maximum	0.979	0.979	0.977
Standard deviation	0.022	0.024	0.020
Distribution	Kurtosis=0.95, Skewness=-0.92		
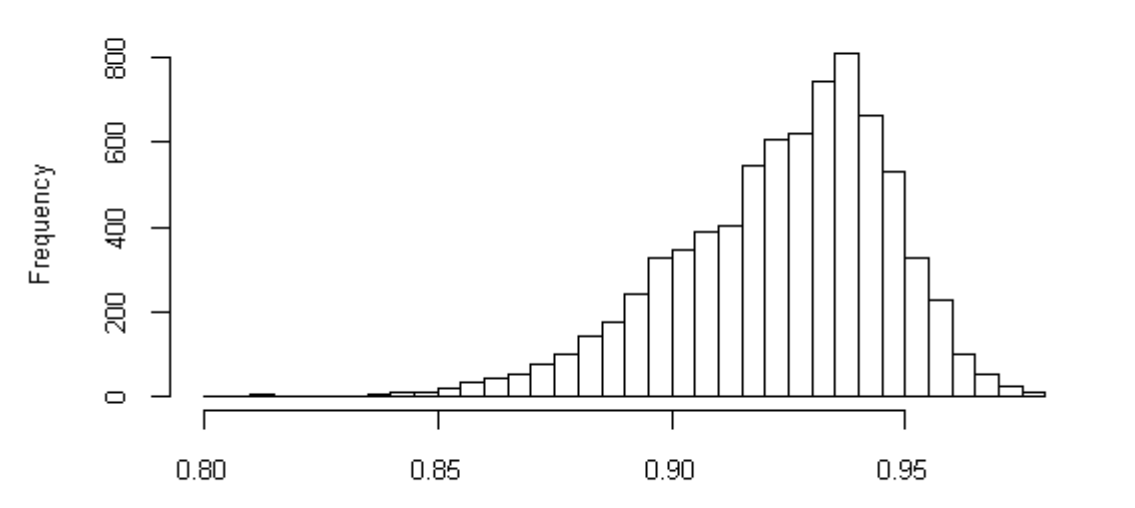
FIGURE 42: NARRATIVE RATIO VALUES HISTOGRAM

FIGURE 43: NARRATIVE RATIO VALUES BOXPLOT

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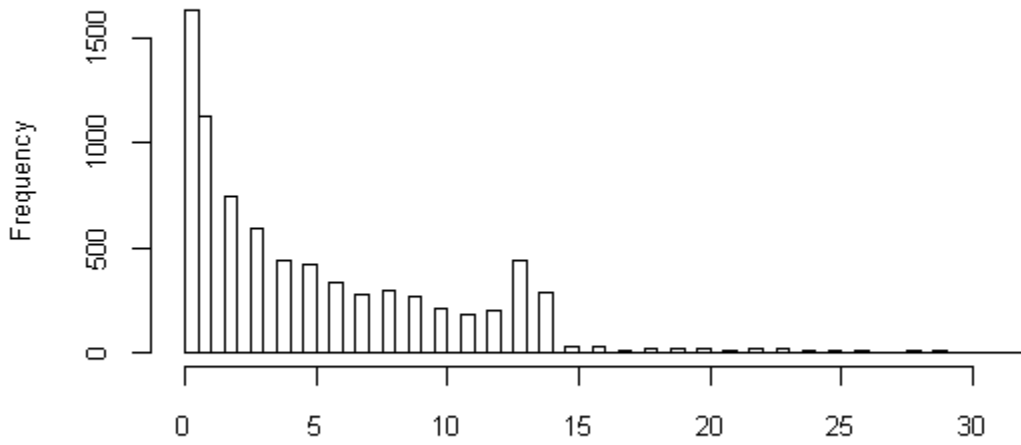| Measure	Overall	Non-First-Tier	First-Tier
N (count)	7618	3236	4382
Mean	4.81	4.56	5.00
Median	3.00	3.00	3.00
Minimum	0	0	0
Maximum	32	29	32
Standard deviation	5.03	4.79	5.18
Distribution	Kurtosis=1.28, Skewness=1.195		

FIGURE 44: PEAK PROXIMITY VALUES HISTOGRAM
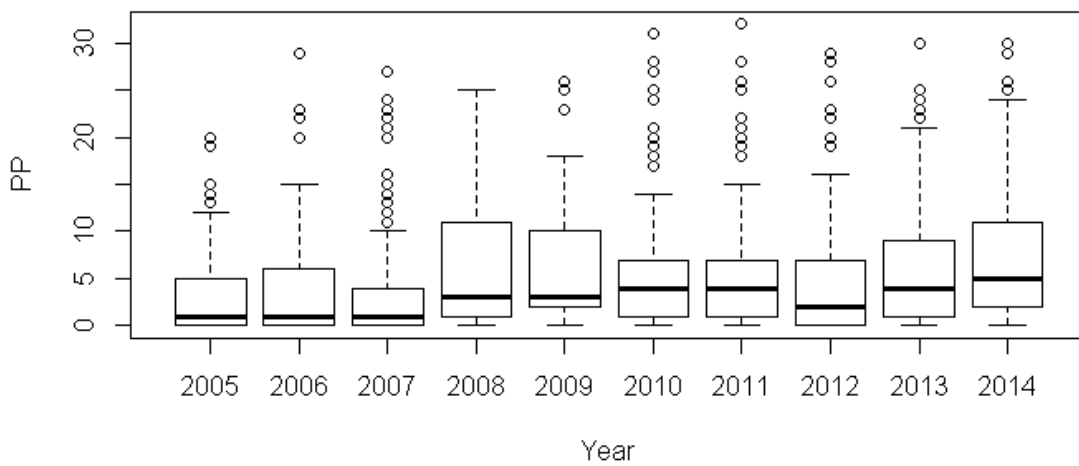
FIGURE 45: PEAK PROXIMITY VALUES BOXPLOT

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TABLE 50: DAYS TO QUARTER 1 END DESCRIPTIVES

Measure	Overall	Non-First-Tier	First-Tier
N (count)	7618	3236	4382
Mean	21.16	17.66	23.75
Median	19.00	17.00	23.00
Minimum	0	0	0
Maximum	62	59	62
Standard deviation	11.32	10.98	10.87
Distribution	Kurtosis=-0.112, Skewness=0.162		
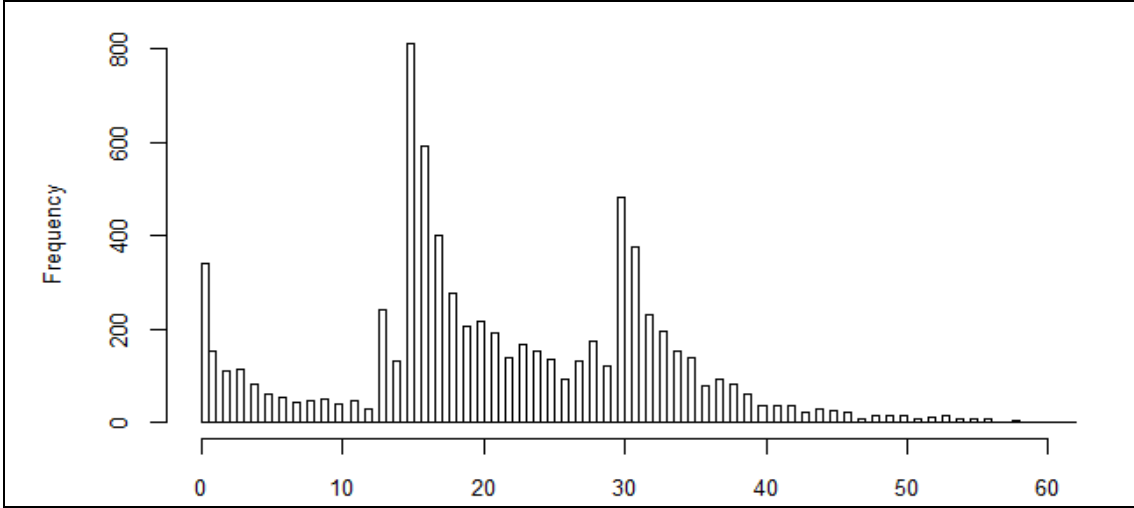
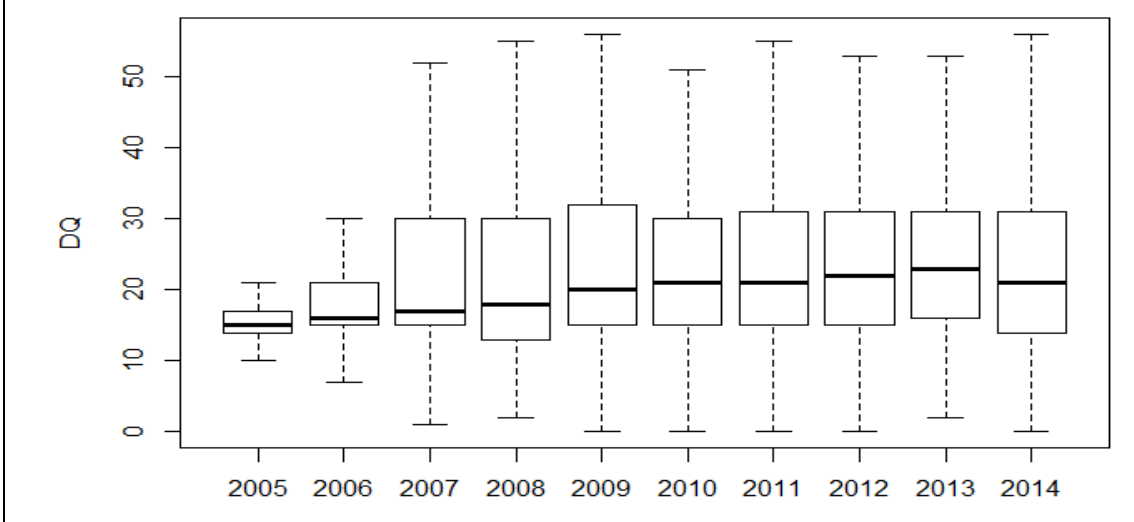FIGURE 46: DAYS TO QUARTER 1 END VALUES HISTOGRAM

FIGURE 47: DAYS TO QUARTER 1 END VALUES BOXPLOT

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TABLE 51: CONCURRENCY DESCRIPTIVES

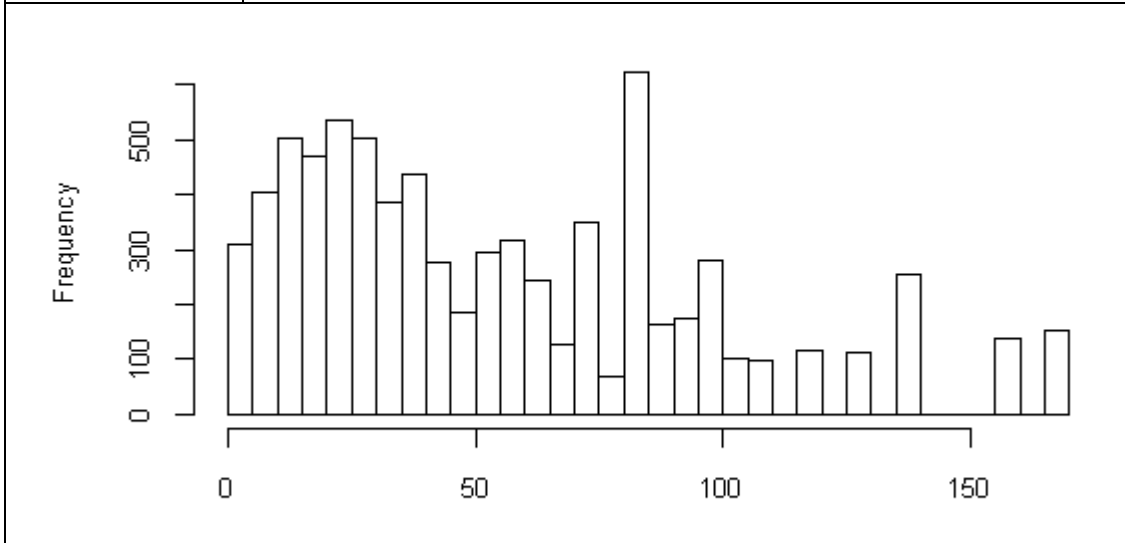| Measure	Overall	Non-First-Tier	First-Tier
N (count)	7618	3236	4382
Mean	55.95	54.83	56.77
Median	45.00	43.00	46.00
Minimum	1	1	1
Maximum	166	166	166
Standard deviation	41.08	40.50	41.48
Distribution	Kurtosis=-0.005, Skewness=0.83		

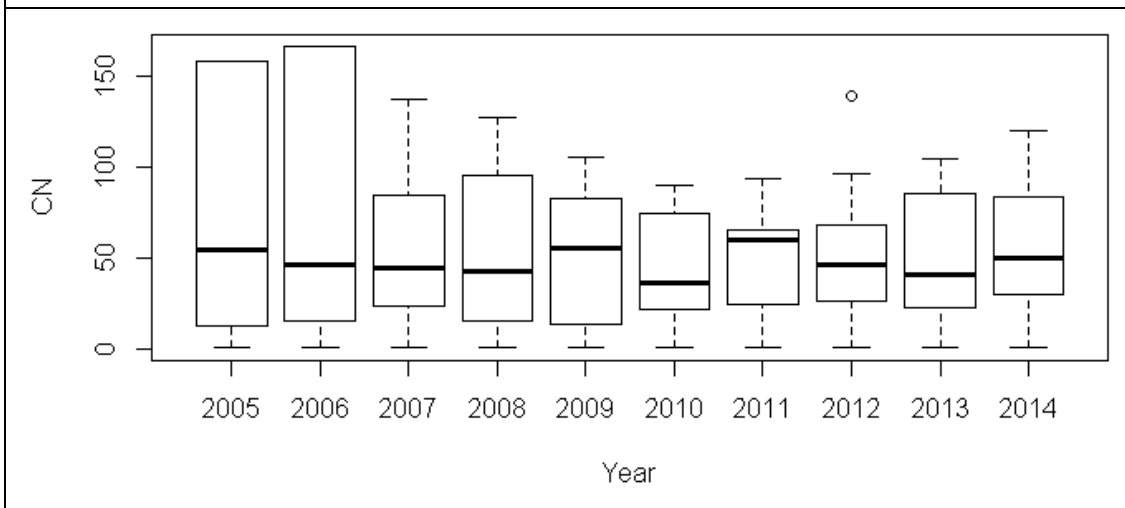FIGURE 48: CONCURRENCY VALUES HISTOGRAM

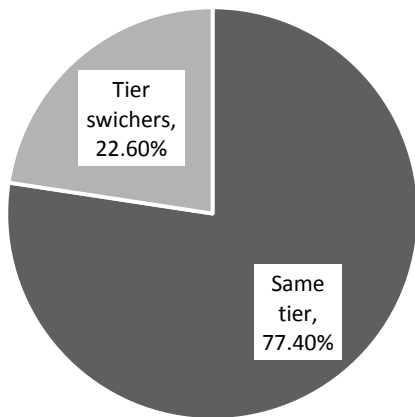FIGURE 49: CONCURRENCY VALUES BOXPLOT
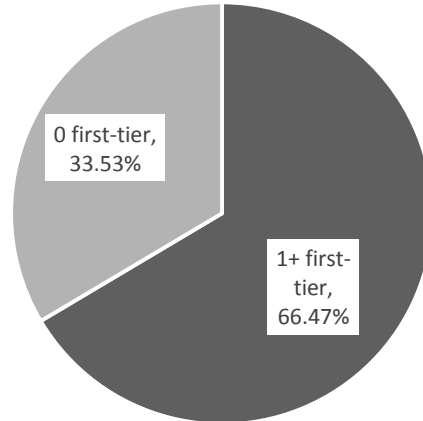
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FIGURE 50: AUDIT-TIER SWITCHERS
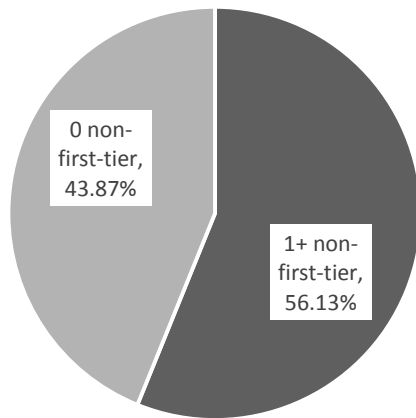

FIGURE 51: FIRST-TIER AUDITED FIRMS

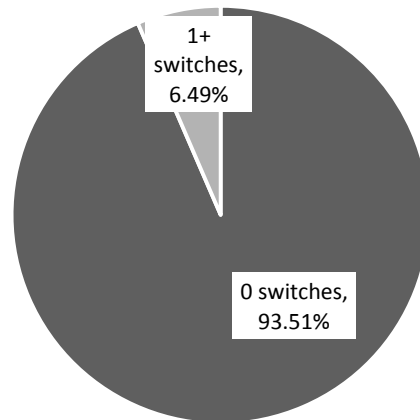**FIGURE 52: NON-FIRST-TIER AUDITED FIRMS**

FIGURE 53: FIRST-TIER SWITCHERS

12.3 EDGAR INTEGRATION

12.3.1 XBRL and FTP access

Integration with SEC EDGAR is made through XBRL (eXtensible Business Reporting Language), which is a global standard for exchanging business information. Since XBRL is XML-based and adheres to common XML conventions as xpath, a choice of C# IDE (in version 2012) is made to manage all transmissions and conducting XML based queries in front of the XBRL interface (made available through C# internal XML parser). For each of the text files residing at the IDX Meta file on EDGAR, a specific data directory is available on EDGAR FTP server. As seen in the following sample, file 1438444/9999999997-08-029633.txt can be accessed online for all additional data, existing at the following URL address: http://www.sec.gov/Archives/edgar/data/1438444.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xbrli:xbrl xmlns:ixt="http://www.xbrl.org/inlineXBRL/transformation/2010-04-20"
            xmlns:xbrli="http://www.xbrl.org/2003/instance"
            xmlns:link="http://www.xbrl.org/2003/linkbase"
            xmlns:xlink="http://www.w3.org/1999/xlink"
            xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
            xmlns:iso4217="http://www.xbrl.org/2003/iso4217"
            xmlns:xbrldi="http://xbrl.org/2006/xbrldi"
            xmlns:xbrldt="http://xbrl.org/2005/xbrldt">
   <link:schemaRef xmlns:us-gaap="http://xbrl.us/us-gaap/2009-01-31"
                   xmlns:us-types="http://xbrl.us/us-types/2009-01-31"
                   xmlns:dei="http://xbrl.us/dei/2009-01-31"
                   xmlns:masd="http://www.massivedynamic.com/20101231"
                   xlink:type="simple"
                   xlink:href="masd-20101231.xsd"
                   xlink:arcrole="http://www.xbrl.org/2003/linkbase"/>
   <dei:DocumentType xmlns:dei="http://xbrl.us/dei/2009-01-31" contextRef="fy10d">10-
K</dei:DocumentType>
   <dei:DocumentPeriodEndDate xmlns:dei="http://xbrl.us/dei/2009-01-31"
contextRef="fy10d">2010-12-31</dei:DocumentPeriodEndDate>
   <dei:EntityRegistrantName xmlns:dei="http://xbrl.us/dei/2009-01-31"
contextRef="fy10d">MASSIVE DYNAMIC INC</dei:EntityRegistrantName>
   <dei:EntityWellKnownSeasonedIssuer xmlns:dei="http://xbrl.us/dei/2009-01-31"
contextRef="fy10d">Yes</dei:EntityWellKnownSeasonedIssuer>
   <dei:EntityCurrentReportingStatus xmlns:dei="http://xbrl.us/dei/2009-01-31"
contextRef="fy10d">Yes</dei:EntityCurrentReportingStatus>
   <dei:EntityFilerCategory xmlns:dei="http://xbrl.us/dei/2009-01-31"
contextRef="fy10d">Large Accelerated Filer </dei:EntityFilerCategory>
   <dei:EntityPublicFloat xmlns:dei="http://xbrl.us/dei/2009-01-31"
contextRef="fy10e_MeasurementDate"
                          unitRef="USD"
                          decimals="0">149769380603000000</dei:EntityPublicFloat>
```

FIGURE 54: XBRL FORMAT SAMPLE

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12.3.2 PDF text extraction

As illustrated in the two following figures, a standard Form 10-K contains various graphical elements within the transmission. After excluding the external attachments, several objects are embedded into the transmission itself, often residing in a portable document format (PDF). These objects do not only include formatting instructions (headlines, style sheets and bookmarks), but also contain table elements and hyperlinks. In order to obtain plain text, that does not contain any special tags or graphical elements, the text extraction process must also perform a filtering process, excluding anything but plain text, and converting rich text data into plain text as well.

In order to extract the text from the PDF, use is made in an open source (GNU license) snippet in C#, utilizing a library named PDFparser. This library has several functions available for opening PDF files (which, in turn are created from the XBRL Meta content within EDGAR), and obtaining a stream that can be saved to disk via C# internal stream writer.

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 10-K

ark One)
ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the fiscal year ended December 31, 2009
OR
TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the transition period from_____ to _____
Commission file number 1-15477

MAXWELL TECHNOLOGIES, INC.
(Exact name of registrant as specified in its charter)

Delaware	95-2390133
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)
9244 Balboa Avenue San Diego, California	92123
(Address of principal executive offices)	(Zip Code)

Registrant's telephone number, including area code: (858) 503-3300
Securities registered pursuant to Section 12(b) of the Act:
None
Securities registered pursuant to Section 12(g) of the Act:
Common Stock, par value $0.10 per share

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. YES ¨ NO x
Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. YES ¨ NO x
Indicate by check mark whether the registrant: (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. YES x NO ¨
Indicate by check mark whether the registrant has submitted electronically and posted on its corporate Website, if and, every Interactive Data File required to be submitted and posted pursua Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files). YES ¨ NO
Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§ 229.405 of this chapter) is not contained herein, and will not be contained, to the best of istrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. x

FIGURE 55: FORM 10-K PDF FORMAT RICH TEXT SAMPLE, PART A

- technologies and designs that improve packaging densities while mitigating the effect of radiation on commercial silicon;
- radiation-mitigation techniques that improve performance while protecting sensitive commercial silicon from the effects of environmental radiation in space; and
- fault-tolerant computer systems with a plurality of processors which avoid deficiencies typically experienced by similar systems due to ionizing radiation.

gh Voltage Capacitors

- manufacture of cells which significantly reduces exposure of internal components to impurities, moisture and other undesired materials which lead to longer manufacturing times and reduced performance characteristics.

Historically, our high-voltage capacitor products have been based on our know-how and trade secrets rather than on patents. We filed our first patent application covering our high-voltage acitor technology in 2003, and we continue to pursue patent protection in addition to trade secret protection of certain aspects of our products' design and production.

Establishing and protecting proprietary products and technologies is a key element of our strategy. Although we attempt to protect our intellectual property rights through patents, demarks, copyrights, trade secrets and other measures, there can be no assurance that these steps will be adequate to prevent infringement, misappropriation or other misuse by third parties, or l be adequate under the laws of some foreign countries, which may not protect our intellectual property rights to the same extent as do the laws of the U.S.

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We use employee and third party confidentiality and nondisclosure agreements to protect our trade secrets and unpatented know-how. We require each of our employees to enter into a prietary rights and nondisclosure agreement in which the employee agrees to maintain the confidentiality of all our proprietary information and, subject to certain exceptions, to assign to us all hts in any proprietary information or technology made or contributed by the employee during his or her employment with us. In addition, we regularly enter into nondisclosure agreements with rd parties, such as potential product development partners and customers, to protect any information disclosed in the pursuit of securing possible fruitful business endeavors.

iancial Information by Geographic Areas

	Year ending December 31,					
	2009		2008		2007	
	Amount	Percent	Amount	Percent	Amount	Percent
			(Dollars in thousands)			
venues from external customers located in:						
United States	$ 40,401	40%	$23,184	29%	$17,195	30%
All other countries	60,914	60%	57,255	71%	39,513	70%
Total	$101,315	100%	$80,439	100%	$56,708	100%
ng-lived assets:						
United States	$ 9,990	56%	$ 8,870	49%	$ 6,153	42%
Switzerland	7,804	44%	9,285	51%	8,483	58%
Total	$ 17,794	100%	$18,155	100%	$14,636	100%

iks Attendant to Foreign Operations and Dependence

We have substantial operations in Switzerland, and we derive a significant portion of our revenues from sales to customers located outside the U.S. We expect our international sales to

FIGURE 56: FORM 10-K PDF FORMAT RICH TEXT SAMPLE, PART B

12.4 C# CODE SNIPPETS

12.4.1 Readability indices calculation

Calculating readability indices of text documents requires a prerequisite of creating entry parameters for readability algorithm calculations. These prerequisite parameters involve parsing of source text to small units (syllables, word length), and extracting single sentences out of the entire text. In order to perform these calculations, a preliminary process takes place in order to remove any grammatical diversities and deviations which may damage readability calculations, such as converting all plural indications to singular, removing relation words (as "it, is, the, and") and dealing with other linguistic sources of bias prior to the parameters calculation.

```csharp
public static class ReadabilityMeasures
{
    /// <summary> ...
    public static double CalculateAutomatedReadabilityIndex(string inputstring)
    {
        int charcount = BasicNLP.RemoveWhitespace(inputstring).Length;  //space characters need to be ignored in character count.
        int wordcount = BasicNLP.Tokenise(inputstring).Length;
        int sentencecount = BasicNLP.SegmentSentences(inputstring).Length;

        double indexval = 4.71 * ((double)charcount / wordcount) + 0.5 * ((double)wordcount / sentencecount) - 21.43;
        return indexval;
    }

    /// <summary> ...
    public static double CalculateGunningFogIndex(string inputstring)
    {
        int sentencecount = BasicNLP.SegmentSentences(inputstring).Length;
        string[] tokens = BasicNLP.Tokenise(inputstring);
        int complexwords = BasicNLP.CountComplexWords(tokens);
        int wordcount = tokens.Length;

        double indexval = 0.4 * (((double)wordcount / sentencecount) + 100 * ((double)complexwords / wordcount));
        return indexval;
    }

    /// <summary> ...
    public static double CalculateFleshKincaidIndex(string inputstring)
    {
        int sentencecount = BasicNLP.SegmentSentences(inputstring).Length;
        string[] tokens = BasicNLP.Tokenise(inputstring);
        int syllablescount = BasicNLP.SyllableCount(tokens);
        int wordcount = tokens.Length;

        double indexval = 0.39 * (((double)wordcount / sentencecount) + 11.8 * ((double)syllablescount / wordcount) - 15.59);
        return indexval;
    }
}
```

FIGURE 57: READABILITY C# SNIPPET

The parsing process is conducted via BasicNLP open source library, which contain designated code segments for text parsing. This library is supplied under GNU freeware license, with a complete source code, and contain basic language processing routines that are required in order to calculate the readability indices.

12.4.2 Ranking of performance and volume figures

The function illustrated in the figure below is designed for ranking a 28-day time frame, which is used as an input by a single dimension array of double variables. The function returns a similar type (double array), replacing original figures with index locations. Since this process is utilized several times (calculating performance/volatility on several dimensions), this function acts as a generic function for all types of ranking calculations.

```
public double[] getreplaceWithRankingssingleline(double[] pparts)
{
    int cnt = 0;
    foreach (var item in pparts.Select((x, i) => new { OldIndex = i, Value = x, NewIndex = -1 })
                    .OrderByDescending(x => x.Value)
                    .Select((x, i) => new { OldIndex = x.OldIndex, Value = x.Value, NewIndex = i + 1 })
                    .OrderBy(x => x.OldIndex))
    {
        pparts[cnt] = item.NewIndex;
        cnt++;
    }

    return pparts;
}
```

FIGURE 58: RANKING C# SNIPPET

12.4.3 Calculating aggregated returns

The function illustrated in the figure below is designed for obtaining aggregated data of performance and volume in multiple days span. This process is conducted in several stages. First of all, opening and closing quotes are sampled from the quotes text file. Later, a ticker+year variable is calculated indicating a unique value made from ticker (firm public identification) and the relevant year. A ticker year is a unique value since firms do not issue

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more than one annual report per year and in addition firms do not share the same ticker. Later, the composite values (marked by a designated ticker) are also sampled for calculating adjusted returns.

The sorted lists are sent to a helper function named calcRetForDays. This function receives an input of the number of days to aggregate, and the lists of both specific firm and a composite index. As illustrated, this function is called two times for full returns calculation (3 and 21 days), and two times for adjusted calculation (also, 3 and 21 days).

```
string[] sneededLines = sneeded.Split(new string[] { Environment.NewLine }, StringSplitOptions.None);
string[] sallLines = File.ReadAllLines(@" FINAL PRICES FILE.txt");
List<string> lstsallLines = sallLines.ToList<string>();
List<singleEntry> singleEntrys = new List<singleEntry>();
foreach (string s in lstsallLines)
{
    //"ticker,date,open,close,volume,year,daily change,tickeryear,yearminus"
    //AAON^03/01/2005^4.8915^4.4498^97040
    //ticker    date    open    close   volume  year    daily change    tickeryear
    //AAME 03/01/2005 3.07    3.07    7927    2005    0.00%   AAME2005
    singleEntry se = new singleEntry();
    se.relDate = DateTime.ParseExact(s.Split('^')[1], "dd/MM/yyyy", CultureInfo.InvariantCulture);
    se.volume = double.Parse(s.Split('^')[4]);
    double dopen = double.Parse(s.Split('^')[2]);
    double dclose = double.Parse(s.Split('^')[3]);
    double dff = 1 - dopen / dclose;
    se.x_open = dopen;
    se.x_close = dclose;
    se.ticker = s.Split('^')[0];
    se.tickeryear = s.Split('^')[0] + se.relDate.Year.ToString();
    singleEntrys.Add(se);
}

StreamWriter file2 = new StreamWriter(@"  ", true);

int cntxxe = 0;
List<singleEntry> CurrsingleEntryscompTMP = singleEntrys.FindAll(e1 => e1.ticker == "$$$$").ToList<singleEntry>();
List<singleEntry> CurrsingleEntryscomp = CurrsingleEntryscompTMP.OrderBy(x => x.relDate).ToList<singleEntry>();

foreach (string lnx in sneededLines)
{
    List<singleEntry> CurrsingleEntrys = singleEntrys.FindAll(e1 => e1.tickeryear == lnx.Split('\t')[1]).ToList<singleEntry>();
    string lnxSplit = lnx.Split('\t')[0];
    double d3 = calcRetForDays(3, CurrsingleEntrys, lnxSplit, CurrsingleEntryscomp, false);

    double d21 = calcRetForDays(21, CurrsingleEntrys, lnxSplit, CurrsingleEntryscomp, false);
    double da3 = calcRetForDays(3, CurrsingleEntrys, lnxSplit, CurrsingleEntryscomp, true);

    double da21 = calcRetForDays(21, CurrsingleEntrys, lnxSplit, CurrsingleEntryscomp, true);
```

FIGURE 59: AGGREGATED FIGURES CREATION C# SNIPPET

12.4.4 Trend detection by dates

The function illustrated in the figure below is designed for calculating values for active trading days only, by restricting the relevance date (relDate) for days after the first publication day (dfilingDate). Relating to the NASDAQ Composite values (singleCOMPEntrys), an adjusted daily value is calculated, which is later used for percentage change of the aggregated days period (input parameter p).

```csharp
private double calcRetForDayX(int p, List<singleEntry> CurrsingleEntrys, string filingdate, List<singleCOMP> singleCOMPEntrys)
{
    List<singleEntry> CurrsingleEntrysSorted = CurrsingleEntrys.OrderBy(x => x.relDate).ToList<singleEntry>();
    DateTime dfilingdate = DateTime.ParseExact(filingdate, "dd/MM/yyyy", CultureInfo.InvariantCulture);
    DateTime firstDay = dfilingdate;
    for (int x = 0; x < CurrsingleEntrysSorted.Count; x++)
    {
        if (CurrsingleEntrysSorted[x].relDate > dfilingdate)
        {
            firstDay = CurrsingleEntrysSorted[x].relDate;
            break;
        }
    }

    DateTime lastdate = firstDay.AddDays(p);
    double retval = 1;

    for (int x = 0; x < CurrsingleEntrysSorted.Count; x++)
    {
        if (CurrsingleEntrysSorted[x].relDate > lastdate) break;

        if (CurrsingleEntrysSorted[x].relDate >= dfilingdate)
        {
            double dailychangeUnadjusted = CurrsingleEntrysSorted[x].dailychange;
            double dailyComposite = 0;

            singleCOMP tmpcomp = singleCOMPEntrys.Find(g1 => g1.relDate == CurrsingleEntrysSorted[x].relDate);
            if (tmpcomp!=null )
            {
                dailyComposite = tmpcomp.dailychange;
            }

            double dailychangeAdjusted = dailychangeUnadjusted - dailyComposite;
            retval *= 1 + (dailychangeAdjusted) / 100;
        }
    }
    return (retval - 1);
}
```

FIGURE 60: TRADE DAYS AGGREGATE CALCULATION C# SNIPPET

Thank you for reading this study.

Any comments and insights will be appreciated.

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May 2016, Tel-Aviv

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