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Véronique WEBER
Born on 16 July 1990 in Esch-sur-Alzette, (Luxembourg)

DETERMINANTS AND USEFULNESS OF RISK DISCLOSURE IN EUROPE: EVIDENCE FROM ANNUAL REPORTS OF LISTED COMPANIES

Dissertation defence committee

Dr Anke Müßig, dissertation supervisor
Professor, Université du Luxembourg

Dr Thomas Kaspereit, Chairman
Professor, Université du Luxembourg

Dr Kerstin Lopatta, Vice Chairman
Professor, Universität Hamburg

Dr Jos van Bommel
Professor, Université du Luxembourg

Dr Matthias Wolz
Professor, Universität Trier

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Abstract

The present dissertation explores risk disclosure in annual reports of European listed companies. It discusses recent findings in the risk disclosure literature, analyses determinants of risk disclosure and examines the usefulness and informativeness of the information disclosed.

What do we know about risk reporting? Recent trends in the risk disclosure literature. Recently published studies show new trends in risk disclosure, an accounting field that is still in its infancy. In this literature review, we present these emerging trends and focus on articles published from 2011 to 2020. Emphasis is placed on the relation between cultural values and risk disclosure. In addition, stock market reactions to risk disclosure are highlighted, specifically convergence, divergence, and boilerplate arguments. New trends in risk disclosure measurement are also presented. Avenues for future research are highlighted for each of the substreams of the literature.

The effect of business strategy on risk disclosure (joint work with Anke Müßig). We analyse a sample of non-financial and non-utility firms from the European Economic Area in 2005–2017 and find that a firm's business strategy is a determinant of the amount of risk factor information in the annual report. Firms with an innovation-oriented prospector strategy report more about their risk factors than firms with an efficiency-oriented defender strategy. We argue this is because, first, prospectors' innovation-oriented strategy leads to higher risk exposure. Such firms face greater risks and uncertainties and should report these accordingly in the annual report. Second, previous studies show that prospectors are more likely to engage in voluntary disclosure. Given the quasi-voluntary or quasi-mandatory nature of risk disclosure in our setting, prospectors are more likely to reveal additional information on risk factors. Further, our findings reveal that the influence of business strategy on risk disclosure in the annual report is stronger for small, young, or low-technology firms.

The effect of risk disclosure on analyst following[1] (joint work with Imen Derouiche and Anke Müßig). Prior research shows that financial analysts play an important information intermediary role in France. This study extends earlier research to examine the effect of risk disclosure on the number of analysts following listed firms. Using a unique dataset of French firms on the 120 SBF

[1] This chapter is published in *The European Journal of Finance, Volume 26, Issue 14.*

index over 2007−2015, the results show a positive and significant relation between risk disclosure and analyst following, suggesting that firms having greater risk disclosure attract more financial analysts. These findings provide empirical support to the argument that analysts incur lower costs of information gathering in firms with greater risk disclosure. The demand for analyst services is also more valuable in these firms, given their potentially high exposure to risks, implying greater analyst following. Overall, our results are in line with prior literature highlighting that analysts' activities complement annual report disclosures and, generally, corporate disclosures.

The relevance of risk disclosure and the role of readability and comparability. For a sample of U.K. listed companies from 2005 to 2017, we analyse whether risk disclosure qualifies as relevant information, as defined by the International Accounting Standards Board (IASB). We test whether the information on risk impacts investor risk perception. We divide risk disclosure into systematic risk disclosure (information on market-wide risk factors), and idiosyncratic risk disclosure (information on firm-specific risk factors), and study the effect of such disclosure on investors' systematic and idiosyncratic risk perception. We find that total risk disclosure, systematic risk disclosure and idiosyncratic risk disclosure are relevant and increase investor risk perception. We further examine whether two enhancing qualitative characteristics defined by the IASB, understandability and comparability, affect the relation between risk disclosure and investor risk perception. Our results show that if risk disclosures are difficult to understand, the firm is perceived to be riskier. This holds for total, systematic and idiosyncratic risk disclosure. High comparability of risk disclosure between peer firms affects the relevance of systematic risk disclosure. A high comparability helps investors put the systematic risk exposure of firms into context. Further, our results show that analyst coverage, foreign ownership and filing speed influence the relevance of risk disclosure.

Contents

Chapter 1. Introduction

[R]isk reporting is still evolving and … users and preparers are still negotiating what the former want to know and what the latter want to provide.

—Association of Chartered Certified Accountants (2014, p. 5)

Financial and economic crises such as the 2007–2008 global financial crisis, nuclear and natural disasters such as the Fukushima nuclear accident or climate change, and health crises such as the Covid-19 pandemic show the immense scope of risks and uncertainties that companies endure (Woods et al., 2016). To assume their responsibility towards their investors, the government, and society, companies should inform their stakeholders about their exposure to such risks. Information about risk should help investors and other information users better evaluate firm risk exposure and expected outcomes (International Accounting Standards Board, hereafter IASB, 2010). Information on firm-specific risk exposure or risk assessment and mitigation is especially difficult to obtain from sources other than the firm itself. Therefore, for investors to make informed decisions, firms should report the principal risks and uncertainties that they face (IASB, 2010).

The aim of this thesis is to analyse the risk disclosure of European listed companies and provide valuable insights into the determinants and usefulness of risk disclosure. Risk disclosure has gained substantial attention from regulators and academics in recent years (e.g. Elshandidy et al., 2018; Financial Reporting Council, hereafter FRC, 2009; Investor Responsibility Research Center Institute, hereafter IRRCi, 2016). To give the reader an overview of the risk disclosure literature, Chapter 2 presents recent findings in the risk disclosure literature. To enhance our understanding of risk disclosure in Europe, Chapter 3 investigates the determinants of risk disclosure. We analyse

whether a firm's business strategy is an important determinant of the amount of risk information revealed in the annual report. Chapters 4 and 5 examine whether risk disclosure is valuable for its users. In Chapter 4, we investigate whether financial analysts use firm risk disclosure, by analysing the relation between risk disclosure and analyst following. In Chapter 5, we study the informativeness of risk disclosure and analyse the relation between firm risk disclosure and investors' perception of firm risk.

Companies are required by regulators to report their risk factors. European listed companies prepare their financial statements according to International Financial Reporting Standards (IFRS), which, according to IFRS 7, require firms to disclosure risks associated or arising from financial instruments. The description of these risks should be both quantitative and qualitative. Further, the IASB recommends that firms provide a Management Commentary in which, among other information, firms should report their risk exposures (IASB, 2010). The Management Commentary has a narrative format, and it supplements and complements the financial statements. Risk disclosure in the management commentary should include internal and external risks and 'should cover both exposures to negative consequences and potential opportunities' (IASB, 2010, p. 13). However, this is a recommendation, not a requirement. At the European Union level, firms are required to provide in their financial statements, or, more precisely, in the management report, a description of the risks and uncertainties that the company faces. Directive 2013/34/EU is a requirement but gives managers a great deal of freedom in its implementation. The extent and detail of risk disclosure is left to management's discretion, and, thus, risk disclosure in the European context is often referred to as quasi-voluntary (Dobler et al., 2011) or quasi-mandatory (Mazumder and Hossain, 2018).

With risk disclosure becoming increasingly important, investors' and regulators' interest in these disclosures has increased, raising concerns about the current risk reporting practices of firms. Risk disclosures have been criticized for being lengthy (Beatty et al., 2019) and too general and generic (IRRCi, 2016). The provision of a generic list of all possible risks seems to result from managers' concerns about future litigation (Beatty et al., 2019). The information provided is said to be repetitive, unclear, and difficult to understand (IRRCi, 2016). Managers appear to fail to communicate to their investors and other stakeholders in a clear and understandable manner.

Regulators thus fear that the information is ultimately not useful (FRC, 2009). Risk disclosure is still in its infancy and needs the dedication of managers, investors, and regulators to improve.

The first step towards better risk disclosure is to understand its determinants. Chapter 3 contributes to the literature on the determinants of risk disclosure by showing that a firm's business strategy is a determinant of the risk disclosures in its annual report. For a sample of 2,344 non-financial and non-utility firms from the European Economic Area from 2005 to 2017, our results suggest that the business strategy, among other firm and country characteristics, determines how much risk information firms reveal in their annual reports. In this study, we adopt the business strategy definition of Miles and Snow (2003) and Miles et al. (1978) that groups firms into three categories: defenders, analysers, and prospectors.

Defenders, who compete on prices, service, and quality, are characterized by a stable organizational structure (Bentley et al., 2013; Higgins et al., 2015). Prospectors adopt a more flexible organizational structure and compete for innovative market leadership (Bentley et al., 2013; Higgins et al., 2015). Analysers incorporate the characteristics of both defenders and prospectors (Miles and Snow, 2003; Miles et al., 1978). Our results show that firms adopting an innovation-oriented prospector strategy are more likely to reveal risk information than efficiency-oriented defenders. This is because, first, the business activities of prospectors are typically riskier (Lim et al., 2018). Prospectors invest in risky projects and face greater uncertainties and ambiguity than firms adopting a different business strategy (Bentley-Goode et al., 2019; Hsieh et al., 2019; Rajagopalan, 1997). Prospector firms should report these risks and uncertainties in the annual report. Second, prospectors are more likely to disclose information voluntarily (Bentley-Goode et al., 2019) and are thus more willing to reveal more information about their exposure to risks. Our findings further reveal that the 2007-2008 global financial crisis does not seem to have had a substantial effect on the relation between business strategy and risk disclosure. Prospectors are more likely to reveal risk information after the financial crisis, but the observed effect is weak. Additionally, our findings reveal that business strategy is a particularly important determinant of risk disclosure for small firms, young firms, and low-technology firms.

After examining the determinants of risk disclosure, we analyse how users react to risk disclosure in Chapters 4 and 5. First, we analyse whether financial analysts are more likely to

follow firms that report more extensively about their risk factor exposure. Next, we analyse if risk disclosure has an impact on investors' perception of firm risk.

In Chapter 4, we investigate the relation between financial analysts and risk reporting in annual reports. Sell-side analysts, that is, those who are employed by brokerage houses, research institutes, or investment banking firms and who issue research reports including earnings forecasts and stock recommendations, play an essential information intermediary role. Previous studies show that analysts typically follow more transparent firms and firms that report more information (e.g. Dhaliwal et al., 2012; Gao et al., 2016; Hamrouni et al., 2017). It is unclear whether this is true for risk disclosure, which contains information that is, by default, negative in nature and could adversely affect a firm's future cash flows (Kim and Yasuda, 2018). For a sample of 113 French non-financial and non-utility firms on the SBF 120 index over the period 2007–2015, our results show that firms that engage in more risk disclosure attract a larger analyst following. Analysts seem to incur lower costs of information gathering in firms with greater risk disclosure. Additionally, the demand for the service provided by analysts is particularly high for firms providing more risk information. Our findings are in line with previous studies (e.g. Lang and Lundholm, 1996; Lehavy et al., 2011) arguing that analysts are information users and that their activities complement but do not substitute for corporate disclosure. Furthermore, we find that the positive effect of risk disclosure on analyst following is particularly high for more opaque firms, that is, firms whose investors inherently face greater challenges in terms of uncertainty and information asymmetry.

In Chapter 5, we analyse whether risk disclosure fulfils one of the fundamental qualitative characteristics of financial information in the IASB's Conceptual Framework. We study if risk information provided in the annual report is relevant, that is, whether it can make a difference in the decision making of information users. For a sample of non-financial U.K. listed companies from 2005 to 2017, we find that, indeed, risk disclosure is relevant and increases investors' perceptions of risk. Unknown risk factors are communicated through the annual report (Kravet and Muslu, 2013). We further follow the call of Heinle and Smith (2017) to distinguish quantitatively between systematic risk disclosure (information on market-wide risk factors) and idiosyncratic risk disclosure (information on firm-specific risk factors). We study the effects of systematic and idiosyncratic risk disclosure on investors' perceptions of systematic and

idiosyncratic firm risk, respectively. Our results show that both systematic risk disclosure and idiosyncratic risk disclosure increase investors' perceptions of systematic and idiosyncratic firm risk, respectively, and we therefore conclude that both are relevant.

One of the concerns of preparing risk disclosures is that the information could be misunderstood by its readers, that is, investors (Association of Chartered Certified Accountants, 2014). Risk disclosures are criticized for being written in legal jargon and for lacking clear language, which makes it difficult for investors to evaluate the risk profile of firms (FRC, 2009; IRRCi, 2016). Thus, to enhance our understanding of risk disclosure in the European context, we measure and analyse the understandability and comparability of risk disclosure. Understandability and comparability are two important pillars of the enhanced qualitative characteristics of financial information defined by the IASB in its Conceptual Framework. Our results show that, if risk disclosures are difficult to read and understand, the firm is perceived to be riskier. High comparability with peer firms also seems to have an effect: if a firm's systematic risk disclosure is comparable to that of peers, the positive relation between systematic risk disclosure and investor perception of systematic risk is reduced. This suggests that high comparability helps investors to put the systematic risk exposure of the firms into context. Overall, our results show that risk disclosures are not boilerplate but, rather, contain valuable information. Nevertheless, managers should place more emphasis on reporting in a clear and understandable manner in order to avoid negative side effects.

The studies presented in this thesis make several contributions to the current state of knowledge on risk disclosure by adding evidence of the determinants and usefulness of risk disclosure to the growing body of literature. Since risk disclosure is weakly regulated in Europe, it is important to investigate what drives firms to report their risks in a quasi-voluntary setting (Dobler et al., 2011) or a quasi-mandatory one (Mazumder and Hossain, 2018). In Chapter 3, we add to the literature on the determinants of risk disclosure by investigating and finding that a firm's business strategy determines how much risk information it reveals in its annual report.

The informativeness and usefulness of risk disclosure have mainly been investigated in the U.S. context. Due to strict risk reporting regulations in the United States, researchers have investigated whether the information is actually informative, besides being compliant with

regulations (Elshandidy et al., 2018). Since risk disclosure is weakly regulated in Europe and researchers thus focus on incentives to provide information (Elshandidy et al., 2018), evidence on the usefulness and informativeness of the risk disclosure of European firms is limited. In Chapter 4, we add to the strand of literature on the usefulness of risk reporting, by analysing, for the first time, whether financial analysts, as important information users, are more likely to follow firms that disclose more. In Chapter 5, we add to the growing body of literature studying the informativeness of risk reporting in Europe. We follow the call of Mazumder and Hossain (2018) to focus not only on *what* is disclosed, but also on *how* risk information is disclosed, by analysing the semantic properties of risk disclosure in the annual report, namely, the readability and comparability of the text.

Further, this thesis adds to the growing body of archival risk disclosure studies outside of the U.S. context (e.g. Abraham and Shrives, 2014; Elshandidy et al., 2015; Miihkinen, 2012). In contrast to the United States, where the Securities and Exchange Commission, the U.S. regulator, provides the open-source search platform EDGAR from which the annual reports of U.S. companies can be freely downloaded, no such platform exists in Europe. This contributes to the sparsity of large-scale evidence on the risk disclosure of European companies. We fill this gap by providing evidence of the risk reporting of 2,344 firms from 30 countries belonging to the European Economic Area in Chapter 3. Our sample of 12,065 firm–year observations from 2005 to 2017 allows for a rather complete picture of risk reporting practices in Europe.

Further, previous cross-country studies have failed to combine country- and firm-specific effects into their analysis (Elshandidy et al., 2018). We fill this gap in Chapter 3 by including in our analysis institutional factors and other country-specific factors, such as the legal system and cultural values, and firm-specific effects, such as firm size, profitability, leverage, and business strategy. In Chapter 4, we further add to the European risk disclosure literature by analysing risk disclosure in France. France is a bank-oriented economy with little minority investor protection and low levels of law enforcement (La Porta et al., 1997). Further, French listed companies have a highly concentrated ownership structure and are mainly controlled by families (Boubaker and Labégorre, 2008). We combine manual and computer-aided content analysis, obtaining a unique data set of the risk disclosures of French listed firms, and provide evidence of an interesting setting that allows for conclusions beyond the U.S. and other European settings.

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Chapter 2. What do we know about risk reporting? Recent trends in the risk disclosure literature

2.1. Introduction

The fundamental idea of firm disclosures is to provide information to a firm's stakeholders (e.g. Li, 2010a). Among other disclosure topics, a firm should report on the risks it faces, to help investors evaluate the firm's risk exposure and expected outcome (International Accounting Standards Board, or IASB, 2010). Such reports reduce the information gap between market participants and allow investors to make well-informed decisions.

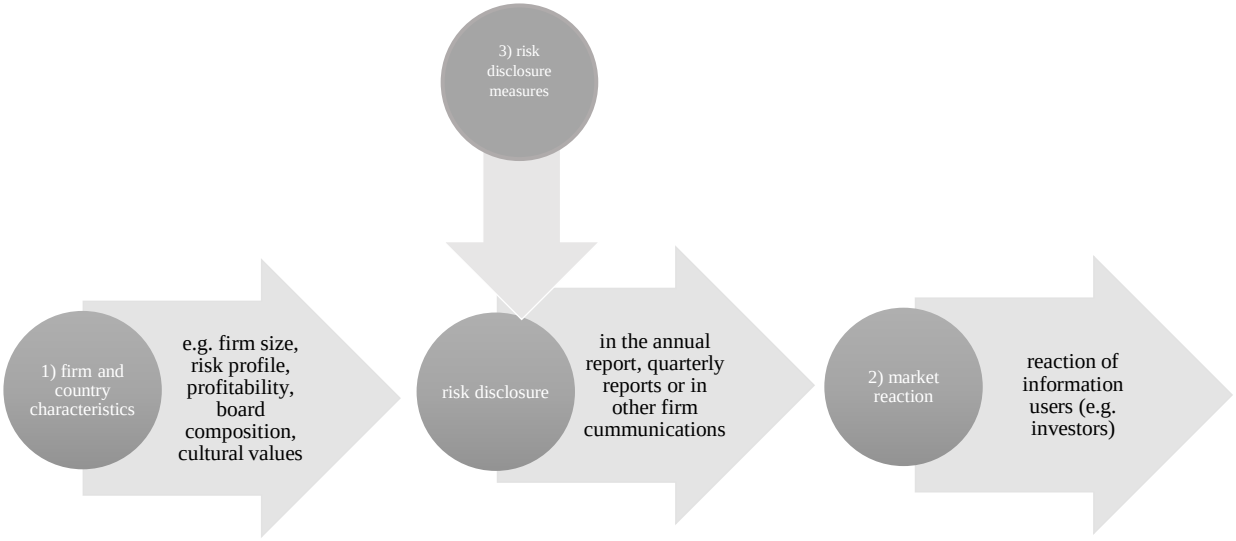
The aim of this chapter is to provide an overview of recent developments in the academic risk disclosure literature. Research on firm risk disclosure has emerged rather recently, with the first papers addressing this topic around two decades ago (e.g. Courtnage, 1998; Linsley and Shrives, 2000). In recent years, an increasing number of studies have focused on risk disclosure, partly due to regulators' growing interest in risk reporting (e.g. Financial Reporting Council, 2009; IASB, 2010; IRRCi, 2016). Further, the 2007–2008 global financial crisis and other corporate scandals call for better risk disclosure practices.

The current literature can be divided into three broad categories that aim at answering the following questions: (1) What firm or country characteristics drive risk reporting behaviour? (2) How do information users react to firm risk disclosure? (3) How do researchers measure risk disclosure?

The categorization is intuitive. First, we look at the internal and external drivers that motivate managers of firms to disclose their risk exposure. How much about their risks do they report, and where? The next step is to analyse how investors and other market participants react to the risk

disclosures. To sum up, we analyse how researchers measure risk disclosure and show recent developments in risk disclosure measurement techniques. Figure 1.1 illustrates our categorization of the risk disclosure literature.

Figure 1.1: Categorization of the risk disclosure literature



This figure illustrates the categorization of the risk disclosure literature. We categorize the literature according to the following questions: (1) What firm or country characteristics drive risk reporting behaviour? (2) How do information users react to firm risk disclosure? (3) How do researchers measure risk disclosure?

For the first category, the stream of literature is rather extensive. A recent literature review that includes a meta-analysis has taken a closer look at studies linking risk disclosure to firm characteristics (Khlif and Hussainey, 2016). Two new emerging areas of research have developed from this stream of literature: first, studies that include multiple countries in their analysis, that is, which concentrate on country-specific characteristics and draw comparisons between countries (e.g. Dobler et al., 2011; Lang and Stice-Lawrence, 2015), and, second, multi-country studies that include cultural values in order to gain a deeper understanding of the risk disclosure behaviour of firms (e.g. Dobler et al., 2016; Elshandidy et al., 2015).

The second stream of literature highlights how the capital market and its participants react to firm risk disclosures. This stream of literature analyses if risk disclosure is relevant and informative. One subcategory of this stream of literature analyses the association between risk

disclosure and investors' risk perception (Bao and Datta, 2014; Campbell, Chen, Dhaliwal, Lu, and Steele, 2014; Kravet and Muslu, 2013). Another subcategory focuses on determining whether risk disclosure reduces information asymmetry between market participants (Bao and Datta, 2014; Miihkinen, 2013).

The last stream of literature identified focuses mainly on how risk disclosure is measured. These studies emerged from the beginning, and researchers are still developing, today, new, improved techniques to measure risk disclosure. We limit the analysis to very new methods to measure the quantity and claimed quality of risk disclosure (Abraham and Shrives, 2014; Atanasovski, Jovanovski, and Jovevski, 2015; Bao and Datta, 2014; Hope, Hu, and Lu, 2016; Jia, Munro, and Buckby, 2016; Madrigal, Guzmán, and Guzmán, 2015; Yang, Yu, Liu, and Wu, 2018).

There have been only a few attempts to provide an overview of the academic risk disclosure literature. Khlif and Hussainey (2016) respond to Solomon, Solomon, Norton, and Joseph's (2000, p. 448) claim that 'there has been little attempt by the academic community to summarize developments in risk disclosure'. Khlif and Hussainey provide an extensive review, including a meta-analysis, of the academic literature, aiming to answer the question of which firm characteristics act as determinants of firm risk disclosure. We highlight their findings in Section 2.3. Li (2010a) has recently reviewed textual analysis studies of the corporate disclosure literature. However, Li does not focus solely on risk disclosure, but on corporate disclosure in general. Onoja and Agada (2015) give an overview of the voluntary risk disclosure literature. They provide insights on the disclosure literature that links risk disclosure to firm characteristics. In addition, they describe the main theoretical frameworks used to explain voluntary risk disclosure behaviour. Elshandidy et al. (2018) have very recently published a literature review on risk disclosure and provide an extensive overview of risk reporting studies published between 1997 and 2016.

In contrast to the study of Khlif and Hussainey (2016), we provide a narrative description of new trends on risk disclosure topics in academic research. Khlif and Hussainey point out that narrative reviews are unsuitable for drawing generalizations and that a meta-analysis would be more suitable. We agree and emphasize that this literature review aims to inform the reader about the recent development of different topics in the risk disclosure literature and compares studies without drawing overall generalizations from the evaluation of the literature. Compared to the

study of Khlif and Hussainey, we do not focus on one research question, but on three research questions, or research clusters, that we have identified in the risk disclosure literature.

In addition, we aim to highlight gaps in the subcategories of the literature we describe and formulate future research questions. Our overview of the risk reporting literature extends the literature review of Elshandidy et al. (2018) by including studies published up until 2020. Elshandidy et al. group studies into two categories, namely, studies on the incentives of risk reporting and those on the informativeness of risk reporting. Our approach is similar, but we enhance their literature review by giving an overview of the methodologies used to measure risk disclosure.

2.2. Theoretical background

There is no universally accepted theory justifying the risk disclosure behaviour of companies. Abraham and Shrives (2014) identify over 10 theories (agency, attribution, contingency, impression management, information cost, information relevance, institutional, legitimacy, modern portfolio, proprietary costs, and signalling theory) that have been used in prior risk disclosure studies. Some studies abstract from using any theory to cover their research question (Abraham and Shrives, 2014). The theories used in previous studies underlying risk disclosure behaviour can be grouped into two categories: the economic theory approach and the social and political theory approach (Khlif and Hussainey, 2016; Oliveira et al., 2013). Agency theory, signalling theory, political cost theory, and proprietary costs theory, which rely 'on self-interest and profit maximization of economic agents' (Khlif and Hussainey, 2016, p. 183), can be grouped under the heading of economic theories. According to agency theory, firms report on their risks to reduce the information gap between informed and uninformed stakeholders and thus reduce agency costs and mitigate information asymmetries (Watts and Zimmerman, 1983). According to signalling theory, by reporting more information about their risks, managers tactically signal investors and other stakeholders their ability in managing these risks (Akerlof, 1970; Elshandidy, Fraser, and Hussainey, 2013). In addition, signalling theory reveals that managers tend to disclose good news to avoid the market's undervaluation of their shares (Inchausti, 1997). According to political cost theory, politically visible companies disclose more to reduce political costs (Watts and Zimmerman, 1986). They can manipulate their image to avoid any unwelcome reactions from information users (Onoja and Agada, 2015). Proprietary costs theory suggests that managers face

a trade-off between disclosing too little, which can signal poor risk management, and disclosing too much, which can incur proprietary costs (Abraham and Shrives, 2014). According to this theory, the decision to disclose private information is a function of subsequent costs (Verrecchia, 1983).

In the social and political approach, institutional theory is the leading theoretical construct used. Managers can mimic the risk disclosure practices of peer leaders with good reputation to signal the same level of disclosure quality (Abraham and Shrives, 2014). In addition, managers can simply avoid changing their disclosure practices and maintain their standard disclosure routines to avoid unwelcome attention (Abraham and Shrives, 2014). According to legitimacy theory, firms disclose risk-related information to signal their legitimacy to society and to avoid reputation damage (Khlif and Hussainey, 2016; Oliveira et al., 2011, Onoja and Agada, 2015). Stakeholder theory centers around the relationship between firms and their stakeholders and the latter's influence on the decisions of managers to report information on risk factors (Amran et al., 2009; Onoja and Agada, 2015).

2.3. Determinants of risk disclosure

Research on the determinants of risk disclosure, which analyses the association between firm characteristics and risk disclosure, constitutes the most extensive part of the risk disclosure literature. What are the drivers behind manager's decisions to report their risks? Khlif and Hussainey (2016) have reviewed this research and conducted a meta-analysis to determine which common firm characteristics influence the level of risk reporting. The authors find a significant and positive relation between corporate size, leverage ratio, profitability, risk factors, and risk disclosure. Previous studies show mixed results for these relations. In addition, Khlif and Hussainey analyse if other features, such as the legal system, uncertainty avoidance, the disclosure regime, the industry, and the measurement of corporate characteristics, have a moderating effect on their findings. The results of the meta-analysis show that a moderating affect can be attributed to those characteristics. The relation between corporate size and the leverage ratio and risk disclosure is significant under a voluntary disclosure regime and in civil law countries. In an uncertainty avoidance setting, the relation between corporate size and profitability and risk disclosure is significant. In addition, Khlif and Hussainey report no significant relation between

risk disclosure and any of the four firm characteristics when financial and non-financial firms are included in the sample.

2.3.1. Cross-country studies on the determinants of risk disclosure

From the growing body of literature on risk disclosure and firm characteristics has emerged the need to conduct cross-country studies. The papers described below respond to Li's (2010a) call to conduct research on cross-country characteristics and their influence on textual disclosure.

The study of Dobler et al. (2011) is the first study to include more than one country in the analysis, aiming to associate risk disclosure with the level of firm risk for four countries, namely, Canada, Germany, the United Kingdom and the Unites States. Different regulatory environments are taken into consideration to fill the gap of multi-country comparative studies. Dobler et al. examine the risk disclosure in management reports and in the notes of financial statements and find differences between countries. The U.S. and Canadian firms in their sample show similar patterns, with two-thirds of their risk disclosures made in the management discussion and analysis (MD&A) and one-third in the notes to financial statements. German and U.K. firms show a slightly different picture; they use the two channels of risk disclosure in a more balanced way. The authors suggest that these differences could originate from the different regulatory environments and accounting standards. When considering the total quantity of risk disclosure, U.S. firms disclose the most, followed by German firms.

Elshandidy et al. (2015) also analyse (voluntary and mandatory) risk disclosure and firm characteristics in a cross-country study that include German, U.K., and U.S. firms. Compared to the study of Dobler et al. (2011), Elshandidy et al. do not include Canadian firms, and they analyse mandatory as well as voluntary firm risk disclosures. The results show that Germany emphasizes mandatory risk disclosure, whereas the United Kingdom adopts a more voluntary risk disclosure regime, while the United States combines both. Elshandidy et al. aim to capture the cultural and legal differences of the three countries and their effects on risk disclosure practices. They emphasize that research in this area should distinguish between voluntary and mandatory risk disclosures, to avoid drawing false conclusions from empirical results using aggregated disclosure scores.

The results of Elshandidy et al. (2015) indicate that, in the United States, which has a highly regulated regime, firms first disclose mandatory risk information as requested by the regulator, and then they voluntarily disclose additional information. In a less regulated environment, such as that of the United Kingdom, firms first disclose risk information on a voluntary basis, as desired by the regulator, and can then include mandatory risk information. Additionally, the authors find that, for Germany and the United Kingdom, mandatory and voluntary risk reporting practices complement each other, rather than substitute for each other. For the United States, the opposite can be observed, with mandatory and voluntary risk disclosures substituting for each other.

Dobler et al. (2011) find that a common feature of all four countries (Canada, Germany, United Kingdom, and United States) used in their study is the fact that firms show a higher proportion of qualitative risk disclosure than quantitative risk disclosure. Further, little emphasis is put on forward-looking disclosure compared to past, present, and non-time-specific disclosure. When categorizing risk disclosure into financial, market, operations, regulatory, and nature risk, the authors find that financial risk disclosure dominates the other categories across all countries in the subsample. On an individual country basis, non-financial risk disclosures outweigh financial risk disclosures for the United States and Germany. For Canada and the United Kingdom, the distribution is more balanced.

In addition to the cross-country comparison described above, Dobler et al. (2011) test whether firm risk is associated with the quantity of risk disclosure. Previous studies show mixed results (Dobler, 2008; Linsley and Shrives, 2006). Dobler et al. (2011) hypothesize no significant association between firm risk and risk disclosure for all four countries. The pooled regression results partly support their hypothesis: for most risk proxies, no significant association is observed. However, a significant association is derived for two risk proxies. In the authors' analysis, beta is a proxy for systematic firm risk, while leverage is a proxy for financial risk. Both are positively and significantly associated with some of the subcategories of risk disclosure quantity. Beta is significantly associated with the quantity of risk in the management report and the quantity of risk related to the risk source. Leverage is significantly associated with the quantity of financial risk, the risk quantity in the notes to the financial statements, and the quantity of risk related to the risk source.

In addition to pooled regression, Dobler et al. (2011) run individual regressions for all four countries. At the individual country level, significant associations between firm risk proxies and the total quantity of risk disclosure can be observed, except for the United Kingdom, confirming Linsley and Shrives' (2006) findings. Comparison of the countries reveals different patterns. The United States is the only country exhibiting a positive association between a non-financial risk proxy and risk disclosure quantity. The United States also shows a significant positive association between leverage and the risk quantity. This holds for Germany too, except that the association is negative. The Canadian sample shows evidence of a significant positive association with beta, whereas the U.K. sample shows a negative one. To be more explicit, the results suggest that, in the United States and Canada, riskier firms disclose more about their risks, whereas, in Germany and the United Kingdom, riskier firms disclose less risk information. Dobler et al. only explain the pattern observed for German firms, that is, a significant negative association between leverage and risk disclosure quantity. They believe that the tendency of German firms to rely primarily on bank debt financing is a likely explanation for the observed relation, since banks, which work as insiders, have access to information through internal channels, so there is no need to provide extensive risk information in the annual report (Dittmann et al., 2010; Leuz and Wüstemann, 2003).

Additionally, confirming the findings of previous studies (e.g. Linsley and Shrives, 2006), Dobler et al. (2011) find a significant positive association between firm size and the quantity of risk disclosure for the pooled regression and at the individual country level. Dobler et al. (2011, p. 18) explain that the results described above can only be partly attributed to the different disclosure regulations in the four countries and emphasize that 'risk disclosure incentives play an important role'.

Why are there differences in risk reporting across countries? There seem to be more than just differences in regulations between the various countries (Dobler et al., 2016). Other factors, such as cultural values, might also play a role.

2.3.2. Risk disclosure and cultural values

In their review of the literature, Khilf and Hussainey (2016) call for cross-country studies that include cultural dimensions in their analysis, to better explain risk disclosure behaviours across countries and in specific industries.

Elshandidy et al. (2015) are the first to have included cultural values in their multi-country risk reporting analysis. They include Hofstede's five cultural dimensions: power distance, uncertainty avoidance, a long-term orientation, individualism, and masculinity (Hofstede, 1991, 2001). The researchers find that German firms, which exhibit higher levels of uncertainty avoidance and a long-term orientation, provide higher levels of mandatory risk disclosure than firms showing low levels of these cultural values. These findings are consistent with those of Khilf and Hussainey (2016), who find that, in a high–uncertainty avoidance setting, which is the case of German firms, corporate size leads to greater risk disclosure. A low level of uncertainty avoidance mitigates the effect. Firms with high uncertainty levels and a strong long-term orientation are more likely to provide reasonable and satisfactory risk information to their investors, to avoid any uncertainty about the firm (Elshandidy et al., 2015). In comparison, firms that show low levels of uncertainty avoidance and high levels of individualism exhibit higher levels of mandatory risk disclosure, compared to firms without these characteristics (Elshandidy et al., 2015). Regarding the fifth cultural dimension, firms that show low levels of masculinity provide higher levels of risk reporting than high–masculinity firms (Elshandidy et al., 2015). Overall, Elshandidy et al. (2015) state that inclusion of the legal system and cultural values significantly improves their model's ability to explain mandatory risk disclosure variations across firms, and thus across countries. They then point out that, to achieve international convergence, the IASB should consider the legal systems and cultural values of individual countries.

A recent study by Dobler et al. (2016) has extended the study of Elshandidy et al. (2015) regarding risk reporting practices and Hofstede's cultural values. Dobler et al. (2016) also extend their own 2011 study and use the same setting. They hypothesize a positive relation between a firm's level of risk disclosure and all five of Hofstede's cultural values. In contrast to Elshandidy et al., who use mandatory and voluntary risk disclosure levels as dependent variables, Dobler et al. use five different dependent variables, and their main goal is to study the association between risk disclosure and cultural values. First, Dobler et al. use the total number of risk-related sentences. Then, they categorize the risk disclosures along two dimensions, distinguishing between financial and non-financial risk disclosures. Next, they categorize disclosures into disclosures on

the risk source and disclosures on risk management.[2] As independent variables, they use firm- and country-specific variables. Consistent with previous studies (Hope 2003; Jaggi and Low, 2000), Dobler et al. control for a country's legal system in their regression analysis. Similar to Elshandidy et al. (2015), they include each of the five cultural values separately into their regression analysis, to avoid econometric issues.

The results of Dobler et al. (2016) for the regression on the total level of risk disclosure confirm their predicted relations, except for masculinity. The results are similar for the levels of financial and nonfinancial risk disclosure. They indicate a positive and significant relation with power distance, uncertainty avoidance, a long-term orientation, and individualism, but no significant relation with masculinity. The same holds for the results when the level of disclosure on risk sources is used as the dependent variable. The picture changes, however, when the level of disclosure on risk management is used, with the results deviating from the predicted associations. Dobler et al. find no significant association of risk disclosure with power distance, and a negative association of risk disclosure with uncertainty avoidance. In addition, they find a significant positive association with masculinity. The conclusion Dobler et al. (2016, p. 58) draw from the evidence is that, in countries with high levels of power distance or uncertainty avoidance, 'disclosures on how risks are managed are relatively less … pronounced than disclosure on risks per se'.

Overall, we note that cultural values do have an impact on different types of disclosures (Dobler et al., 2016), and that these impacts should be kept in mind for further research.

Ríos-Figueroa's 2016 study also links risk disclosure to cultural values. That study uses Gray's (1988) cultural values. Gray has developed the following set of accounting values, derived from Hofstede's values: professionalism versus statutory control, uniformity versus flexibility, conservatism versus optimism, and secrecy versus transparency. Ríos-Figueroa's study concentrates on the values of secrecy and conservatism. The author uses the 2012 annual reports of 62 firms from 18 different countries. In contrast to the studies described previously, the author does not find any significant relation between secrecy or conservatism and the level of risk

[2] Dobler et al. (2016) use the same subcategories of total quantity of risk disclosure as they did in their 2011 study, described above, as well as the same data.

disclosure measured. One likely explanation is that the two cultural values, secrecy and conservatism, do not capture the drivers behind risk disclosure. Hofstede's cultural values seem to capture the underlying drivers of managers reporting risk information better than Gray's values.

One constraint of the studies of both Dobler et al. (2016) and Ríos-Figueroa (2016) is that their analyses are based on one year only. An interesting aspect of the two papers by Dobler et al. (2011, 2016) is the distinction between disclosures on risk sources and disclosures on risk management. Unfortunately, the authors do not provide further details on how they distinguish between the two or how they code the texts. The lack of a detailed description of the coding makes their studies difficult to replicate.

2.3.3. Board characteristics as determinants of risk disclosure

To better understand firm risk disclosure practices, researchers have focused their attention towards company boards of directors. For a sample of 169 non-financial firms listed on the Johannesburg Stock Exchange from 2002 to 2011, Ntim et al. (2013) find that the structure of the board plays an important role in firms' risk disclosure behaviour. Ntim et al. find that board size, ethnic and gender board diversity, and the percentage of independent non-executive directors are positively associated with risk disclosure. This is because large boards and boards with a high degree of diversity put more pressure on managers to engage in risk disclosure (Ntim et al., 2013). Further, dual board leadership does not seem to have an effect (Ntim et al., 2013).

The findings of Moumen et al. (2016) draw a similar picture. For a sample of 320 listed companies from nine Middle Eastern and North African emerging markets from 2007 to 2009, the authors find that the size and composition of the board – and therefore the percentage of outside non-executive directors – improve the informativeness of risk disclosure about future earnings[3] (Moumen et al., 2016). Investor trust is higher for firms with a diverse board, since diversity is believed to increase board expertise and enrich the information environment. Non-executive board members have a monitoring role and can limit the self-serving behaviour of inside board members

[3] The authors define the informativeness of risk disclosure 'as the extent to which voluntary risk information improves the amount of future earnings news impounded into share prices' (Moumen et al., 2016, p. 95).

(Moumen et al., 2016). Similar to the findings of Ntim et al. (2013), dual board leadership does not have an influence on the informativeness of risk disclosure.

2.3.4. Opportunities of future research

All the studies described above look solely at the level of risk disclosure. It would be interesting to see how cultural values and other properties of risk disclosure, such as semantic properties, interact. In addition, the studies above categorize firms according to the country in which they are listed. To capture all the determinants of firm risk disclosure behaviour, future research could include the country of origin of the chief executive officer, chief financial officer, or chief risk officer, to link cultural values to risk disclosure. The determinants of risk disclosure could be manager specific. The studies above link firms to cultural values; that is, German firms tend to show higher levels of uncertainty avoidance and thus provide higher levels of risk disclosure (Elshandidy et al., 2015). However, is it the firm that drives this at a superior level, or are the top managers doing so at a more individual level? One possible extension of the studies described above is to focus on the origin countries of the firm decision makers, instead of the country in which the firm is listed.

2.4. Risk reporting and stock market reactions

In the accounting literature, an increase in disclosure is expected to reduce a company's cost of capital (Botosan, 2006). Botosan (2006) presents an overview of the literature studying the relation between disclosure and the cost of capital and mostly the cost of equity. The author shows the theoretical concept behind the positive association between disclosure and the cost of equity. Reduced costs of equity can be due to either a reduction in investors' estimation risk (Barry and Brown, 1985; Klein and Bawa, 1976) or a reduction in information asymmetry and/or transaction costs (Amihud and Mendelson, 1986; Easley and O'Hara, 2004). Estimation risk is said to be non-diversifiable and is therefore positively associated with a company's cost of capital. Analysts and investors are uncertain about future payoffs and the return parameters of a security, and thus greater estimation risk leads to higher costs of capital, due to the uncertainty and potential estimation error of the underlying payoffs and parameters of the security (Barry and Brown, 1985; Klein and Bawa, 1976). An increase in disclosure is said to reduce information asymmetry as more information becomes available to all investors (Amihud and Mendelson, 1986; Easley and O'Hara, 2004).

Therefore, adverse selection costs are reduced, which reduces the bid–ask spread and thus increases the liquidity of the security[4] (Dolgopolov, 2012). The disadvantage that uninformed investors have when they trade with informed investors is reduced, and thus the return demanded by uninformed investors to compensate for trading at a disadvantage is reduced. The cost of capital declines (Easley and O'Hara, 2004). In addition to the other two effects, Campbell et al. (2014, p. 403) present another explanation for the reduction in the cost of equity, namely, an increase in the precision of disclosure that leads to a decrease in 'the assessed covariance between a firm's cash flows and the market's cash flows (market beta)'. It is subject to debate whether risk disclosure – which contains information that is, by default, negative and could adversely affect the firm's future cash flows – is informative and whether it reduces or increases the cost of capital (Kim and Yasuda, 2018).

2.4.1. Boilerplate, divergence, and convergence arguments

There are three competing arguments on the informativeness of risk disclosure (Kravet and Muslu, 2013). The first argument is that risk disclosure is not informative and can be described as boilerplate. The second argument is that risk disclosure increases investors' risk perception by introducing unknown risks and contingencies to the market. Contrary to this, the third argument is that risk disclosure decreases investors' risk perception by resolving known risks and contingencies. The former argument is also referred to as the divergence argument, and the latter as the convergence argument (Kravet and Muslu, 2013; Garfinkel, 2009). Table 1.1 provides overviews of the conclusions drawn by the papers discussed in this section with regards to the three competing arguments. Table 1.2 provides overviews of the proxies the papers use to measure investors' risk perception, which we discuss in greater detail in this section.

[4] In the literature, three components are said to influence the bid–ask spread, that is, order processing, inventory holding, and adverse selection costs (Dolgopolov, 2012).

Table 1.1: Overview of the divergence, convergence, and boilerplate arguments

Author (year)	**Divergence argument: Increases** investors' risk perception	**Convergence argument: Decreases** investors' risk perception	**Boilerplate argument:** not informative
Kravet and Muslu (2013)	✓		✓ (partially)
Bao and Datta (2014)	✓	✓	✓
Campbell et al. (2014)	✓		
Elshandidy and Shrives (2016)	✓	✓	✓
Li et al. (2019)		✓	
Kim and Yasuda (2018)		✓	

This table provides overviews of the conclusions drawn by previous studies with regards to the divergence, convergence and boilerplate arguments.

Table 1.2: Overview of the measurements of investor risk perception

Author (year)	**How investor risk perception is measured and the dependent variables in the regression models**
Kravet and Muslu (2013)	Change in the volatility of daily stock returns, change in the ratio of the volatility of negative stock returns to the volatility of positive stock returns, change in the trading volume around the filing date, change in the trading volume, and the dispersion of forecast revisions
Bao and Datta (2014)	Daily stock return volatility
Campbell et al. (2014)	Standard deviation of daily stock returns, beta, three-day abnormal return
Elshandidy and Shrives (2016)	Stock return volatility, bid–ask spread, abnormal return
Hope et al. (2016)	Three-day abnormal return
Li et al. (2019	Investment efficiency (absolute value of over- or underinvestment; see Richardson, 2006)
Kim and Yasuda (2018)	Standard deviation of daily stock returns

This table summarises how previous studies measure investor risk perception.

Kravet and Muslu (2013) find clear evidence for the divergence argument. Their analysis uses five different dependent variables to test the hypothesis on whether risk disclosure supports the boilerplate, divergence, or convergence argument. For dependent variables, the authors use the change in the volatility of daily stock returns, the change in the ratio of the volatility of negative stock returns to the volatility of positive stock returns, the change in the trading volume around the filing date, the change in the trading volume, and the dispersion of forecast revisions. They find significant and positive associations between their risk disclosure metric and all of the dependent variables, which confirms the divergence argument. Risk disclosure increases investors' risk perception. New unknown risks and contingencies are communicated by companies through the channel of risk reporting.

Campbell et al. (2014), consistent with Kravet and Muslu (2013), also find a positive association between risk disclosure and stock return volatility. In addition, they find a significant positive association between risk disclosure and beta. This is evidence for the divergence argument. In contrast to Kravet and Muslu (2013), Campbell et al. do not employ the notions of divergence and convergence. They interpret their results in the sense that 'market participants incorporate the information conveyed by risk factor disclosures into their assessments of firm risks' (Campbell et al., 2014, p. 438).

Elshandidy and Shrives (2016) complement Kravet and Muslu's (2013) findings by introducing tone into their analysis. They distinguish between the disclosure of good and bad news about risks. For the disclosure of bad news about risks, they find a significant and positive association with stock return volatility, which they acknowledge as support for the divergence argument; unknown risk is introduced and thus increases investors' risk perception (Kravet and Muslu, 2013). In contrast, Elshandidy and Shrives find a significant and negative association between the disclosure of good news about risk and stock return volatility. This confirms the convergence argument, which states that known risks are resolved (Kravet and Muslu, 2013). Here again, Elshandidy and Shrives do not employ the terminology of divergence and convergence, although they do refer to the paper of Kravet and Muslu (2013). They employ the definition of the divergence and convergence arguments, without explicitly naming them as such.

In addition to their analysis described above, Kravet and Muslu (2013) divide their risk disclosure measure into a firm-specific part and an industry-specific part. They rerun their five regressions, including the two measures as independent variables. The regression coefficient of the change of industry-level risk disclosure is significantly higher than the coefficient of firm-specific risk disclosure for all the regressions run. This result indicates that the influence of industry-level risk disclosure on investors' risk perception is much greater than the influence of firm-specific risk disclosure. The evidence supports regulators' observation that risk disclosure lacks firm-specific information and could be interpreted as supporting the boilerplate argument.

Campbell et al. (2014) reject the boilerplate argument. They find significant associations between different risk proxies for systematic, idiosyncratic, financial, legal, and tax risk and their risk disclosure metric. They conclude that firms disclose the risks they actually face.

Bao and Datta (2014) find evidence for all three competing arguments. Of the 30 risk disclosure types they identify, 22 lack informativeness, thus supporting the boilerplate argument. Three of the types, that is, disclosures on macroeconomic risks, funding risks, and credit risks, are significantly positively associated with investors' risk perception. This finding supports the divergence argument. Information disclosed about macroeconomic risks, and, thus, systematic risks, is informative to investors. Bao and Datta suggest that this could be due to the fact that systematic risk cannot be diversified away and, thus, investors react to this information. In addition, consistent with the work of Li (2010b), the positive and significant coefficients on funding risks and credit risks, which Bao and Datta group under the heading of liquidity risks, increase investors' post-disclosure risk perception. Bao and Datta also find evidence favouring the third argument, the convergence argument. They find human resources risks, regulatory change risks, and infrastructure risks to have significant and negative associations with investors' risk perception, lending support for the convergence argument by resolving a firm's known risks (Garfinkel, 2009). Bao and Datta (2014, p. 1389) claim that their results deviate from those of other studies because they use more 'fine-grained risk types'.

Hope et al. (2016) introduce a new measure, which we describe in greater detail in Section 2.5. Similar to Campbell et al. (2014), they analyse the relation between three-day abnormal returns around the filing date and risk disclosure. In contrast to Campbell et al., however, they use the absolute value of abnormal returns. Hope et al. use their own, new measure, *Specificity*, a measure of the quality of risk disclosure, for their analysis. The more specific the risk disclosure, the higher the quality. Their use of a measure of risk disclosure quality is in contrast to the studies described above, which use a measure of risk disclosure quantity. Supporting previous findings, Hope et al. (2016, p. 1032) find a significant and positive association between their risk disclosure metric and abnormal returns, suggesting that 'investors find specific risk disclosures incrementally valuable in assessing firms' accounting information'.

In a recent study on risk disclosure in the annual reports of Chinese A-share firms from 2007 to 2014, Li et al. (2019) find support for the convergence argument. If the frequency of risk disclosure in the MD&A is high, the authors find that investment efficiency improves. They define investment efficiency as the absolute value of over- or underinvestment, with a high (low) value indicating low (high) investment efficiency. Further, Li et al. show that the effect of risk disclosure

on investment efficiency is stronger when the MD&A has a positive tone and more information, that is, keywords, about investment. They argue that this is proof of the convergence argument: the disclosures give additional information and explanations about known risks, rather than introducing new ones. Their study differs from previous ones (e.g. Kravet and Muslu, 2013) by analysing a capital market that is less mature than the U.S. capital market.

Kim and Yasuda (2018) study risk disclosure in Japan with a sample of 1.799 annual reports of firms listed on the Tokyo Stock exchange. They analyse the 2002 and 2003 annual reports, since risk disclosure became mandatory in Japan in fiscal year 2003. Similar to Li et al. (2019), their research setting differs from that of other studies and allows for a natural experimental setting to study the causal effect of the introduction of mandatory risk disclosure. Kim and Yasuda find that the introduction of mandatory business risk disclosure reduces a firm's cost of capital by negatively affecting total firm risk. The authors further find that the amount of business risk disclosure increases investors' assessment of firm risk after the mandatory introduction phase. Total firm risk, measured by the standard deviation of daily stock returns, and, subsequently, the cost of capital both increase. Thus, Kim and Yasuda find risk disclosure to have both enhancing and reducing effects on the cost of capital, but conclude that the two effects offset each other, with the reducing effect being stronger. The net effect is thus evidence in support of the convergence argument.

Heinle and Smith's (2017) theoretical multi-asset model shows that neither idiosyncratic risk uncertainty nor idiosyncratic risks are priced, and the capital market therefore only reacts to systematic risk disclosure. The authors suggest that market prices react more strongly to systematic risk disclosure, and they therefore call for distinguishing between risk disclosure regarding systematic risk and risk disclosure regarding idiosyncratic risk in empirical studies. Kravet and Muslu's (2013) and Bao and Datta's (2014) findings hint at the theoretical rationale demonstrated by Heinle and Smith, that industry-level and macroeconomic risk disclosure is positively associated with investors' risk perception. This result is consistent with the notion that idiosyncratic risk can be diversified away (Fama and French, 1993; Heinle and Smith, 2017). Focusing on the association between market-based risk measures, Campbell et al. (2014) find that systematic information in risk disclosure is incorporated into the market beta, which captures a firm's exposure to systematic risk, while idiosyncratic information from risk disclosure is

incorporated into stock return volatility, which captures firm-specific risk exposure. Bao and Datta show that risk topics that convey firm-specific information negatively influence investors' risk perception.

2.4.2. Risk disclosure and information asymmetry

A subcategory of the literature on risk disclosure and stock markets links risk disclosure to information asymmetry. Miihkinen's (2013) analysis uses two proxies for information asymmetry: the relative bid–ask spread and the trading volume. The author finds a significant and negative association between the bid–ask spread and the risk disclosure metrics. This suggests that risk disclosure reduces information asymmetry between market participants. In addition, Miihkinen tests if this association is stronger for small firms and high-tech firms, since both are said to have increased inherent risk (Miihkinen, 2013). The authors find evidence that the negative relation between risk disclosure and information asymmetry is stronger for these firms. In addition, the author finds that the association is stronger for firms with a low analyst following, because investors rely more on the firm's own disclosures, since less information provided by analysts is available. Miihkinen's results also suggest that the relation between risk disclosure and information asymmetry is less pronounced for rising stock markets than for falling or recovering stock markets; that is, risk information is more informative in times of falling or recovering stock markets. The results are confirmed when trading volume is used as a proxy for information asymmetry. Miihkinen finds a positive association between risk disclosure and trading volumes, where trading volumes increase due to low information asymmetry.

Consistent with Miihkinen's (2013) research design, Elshandidy and Neri (2015) analyse whether market liquidity, proxied by the bid–ask spread, is associated with their voluntary and mandatory risk disclosure metrics. The authors include U.K. and Italian firms in their sample. Their results show that, for U.K. firms, voluntary as well as mandatory risk disclosure reduces information asymmetry and thus improves market liquidity. As well as differentiating between voluntary and mandatory risk disclosures, the authors add another dimension to their analysis by dividing their sample into strongly governed firms and weakly governed firms. For Italian firms, voluntary risk disclosure reduces information asymmetry, but no significant relation is observed between mandatory risk disclosure and market liquidity for Italian firms (Elshandidy and Neri, 2015). Elshandidy and Neri (2015) argue that this result constitutes evidence of Miihkinen's

(2012) claim that more regulation does not necessarily lead to more informative risk disclosures, leading, instead, to boilerplate and generic risk disclosures.

Campbell et al. (2014) use the bid–ask spread as a proxy for information asymmetry and analyse whether risk disclosure is associated with information asymmetry, after controlling for investors' risk perception. They find a significant and positive association. Risk disclosure introduces more publicly available information and thus reduces information asymmetry between market participants.

Elshandidy and Shrives (2016) use market liquidity to test whether risk disclosure improves the market liquidity between capital market participants. They use the bid–ask spread as a proxy for market liquidity and test if information asymmetry is reduced following the release of risk disclosure. In contrast to Campbell et al. (2014), they do not find a significant relation between their aggregate risk reporting metric and the bid–ask spread. Elshandidy et al. (2016, p. 477) claim that investors do not incorporate the information into their decision making process and that the firms in their German sample provide risk disclosure 'in a somewhat "boiler-plate" fashion'.

2.4.3. Opportunities for future research

An interesting avenue of future research is the examination of different measures of risk disclosure on the same sample, to see how the results differ with regards to the informativeness of risk disclosure.

Previous studies have captured the reactions of stock market participants to firms' risk disclosures. An interesting extension in this area would be to capture the reactions of bond markets to firms' risk disclosure practices.[5] It seems rather common in the accounting literature that, first, the association of the accounting topic with the equity market is extensively studied, and then the association of the accounting topic with the bond market is analysed. Arguably, however, equity holders typically have greater interest in the risk of future cash flows, since they would be paid after debt holders. Thus, debt holders' interest in firm risk disclosure could be low.

[5] Kravet and Muslu (2013) and Elshandidy et al. (2018) suggest this too as an avenue for future research.

2.5. Risk disclosure measurement

Early work in the area of risk reporting has focused on how to measure risk disclosures. A measure of risk disclosure quantity is the common metric used in the first wave of research studies (Abraham and Cox, 2007; Linsley and Shrives, 2006). The second wave of studies then tried to develop metrics to measure the quality of risk disclosure (Abraham and Shrives, 2014; Beretta and Bozzolan, 2004a; Hope et al., 2016).

An attempt by Beretta and Bozzolan (2004a) to develop a new model to assess the quality of risk disclosure was criticized for using quantity as a proxy for quality. Recent papers have tried to develop new models to measure quality independent of quantity (Abraham and Shrives, 2014; Atanasovski et al., 2015; Hope et al., 2016; Madrigal et al., 2015). Their authors want to distance themselves from mere word-counting techniques to measure risk reporting. In this section, we focus on recent developments in the risk disclosure measurement literature. We discuss recent papers that present new or improved means of measuring the quality of risk disclosure. The quantity of risk disclosure, a metric we will not discuss in greater detail, is a content analysis metric that consists of a word count in its most basic form, where the word *risk* or derivatives thereof are counted in a text. Many studies use so-called keyword lists, lists of risk-related words, as a basis for their text extraction (Abraham and Cox, 2007; Campbell et al., 2014; Elshandidy et al., 2013, 2015; Elshandidy and Neri, 2015). There is no universally employed method to measure risk disclosure quantity, however. Recently, a certain consensus on counting sentences containing risk-related words, instead of counting risk keywords, in the risk disclosure section of annual reports seems to dominate (Abraham and Cox, 2007; Abraham and Shrives, 2014; Dobler et al., 2011; Linsley and Shrives, 2006). This approach avoids counting an item of risk information more than once (Kravet and Muslu, 2013). Quite a few attempts have been recently made to measure risk disclosure quality. Being so new, these studies have not yet been tried and tested by other researchers. Consequently, there is still no consensus among academics on a sound risk disclosure quality measure.

The first paper to introduce the notion of risk disclosure quality is that by Beretta and Bozzolan (2004a). They attempt to provide a new model to assess the quality of voluntary risk disclosure. They introduce the concept of a company's risk communication profile. This risk communication can be displayed in a graph, which enables comparisons with the risk-communication profiles of

other companies. The authors state, however, that the graphical representation of the risk communication profile of more than two or three companies at a time is illegible. As stated above, their measure was also criticized for measuring risk disclosure quality as a function of risk disclosure quantity (Botosan, 2004; Beretta and Bozzolan, 2004b).

For the remainder of this section, we analyse recent attempts to measure the quality of risk disclosure. We divide these studies into three categories, based on the technique of measuring risk disclosure, that is, content analysis, indices, and machine learning.

2.5.1. Content analysis

Jia et al. (2016) adopt part of the framework developed by Beretta and Bozzolan (2004a). Jia et al. do not reject the idea that quality is a function of quantity; for them, management risk disclosure has two dimensions: a quantity and a richness dimension. Accordingly, quantity is an indicator of the 'effort that companies employ in providing comprehensive risk management disclosure' (Jia et al., 2016, p. 777). In this context, the authors distinguish between 'information relevant to risk management' and 'information not relevant for risk management' (Jia et al., 2016, p. 777). Their richness dimension is divided into width and depth subdimensions. Width, in this context, sets the range of risk categories outlined in the risk disclosure statement. If a firm discloses operational or legal risks instead of general risks, this disclosure is perceived by Jia et al. as being more specific risk information.[6] The depth notion includes a time orientation, where forward-looking risk information is the most useful; a type aspect, whether financial or non-financial, or monetary or non-monetary, with financial and monetary risk information being high quality; and the economic sign, where positive or negative risk information is more informative than unsigned information. The authors use sentences as coding units for their analysis.

Abraham and Shrives (2014) adopt a new approach to measure risk disclosure quality. They aim to determine whether companies provide risk information that is specific to the company. In addition, the authors analyse whether risk reports have changed over time. They scan prior risk reports to see if significant events were identified, where significant events are defined as events or, rather, new information that has led to high share price increases or decreases. More precisely,

[6] Jia et al. (2016) identity 13 different risk categories based on a recommendation of the Australian Securities Exchange Corporate Governance Council (2010).

a significant event is identified if the adjusted return is one standard deviation away from the mean. Similarly, Abraham and Shrives scan subsequent risk reports to determine if the significant events identified were discussed. This approach is difficult to implement on a larger scale.

To assess whether the risk information in the risk report is specific or not, Abraham and Shrives (2014, p. 97) divide risk factors into 'factors that are general in nature which apply to any business or any business with the industry', which they describe as symbolic, and 'factors that are company specific', which they describe as substantive. Hope et al. (2016) also use the notion of specific risk information in their assessment of risk disclosure quality. They use the named entity recognition technique to identify whether firms use the names of persons, the names of locations, the names of organizations, quantitative values in percentages, money values in dollars, times, and dates in their risk factor disclosures. This would make the risk information more specific, hence the term *specificity* to describe the new risk disclosure quality measure of Hope et al. The idea per se is not new. As described above, Abraham and Shrives use the idea of specific risk information as well. Hope et al., however, introduced the named entity recognition technique to the research topic, making it easier to analyse risk reports or risk factor sections on a larger scale, using software packages.

Another important concept is similarity. Abraham and Shrives (2014) analyse whether the information disclosed by a firm has changed over the years. A high similarity measure would mean that the information in a company's risk report or risk factor section did not change much compared to the previous year's. Specific information and difference over time are important pillars of risk disclosure quality.

Yang et al. (2018, p. 584) criticize previous papers for using the keyword count to measure risk disclosure, since keywords do not lead to 'accurate precision and recall due to polysemy (a word or phrase having different meanings in different context) and synonymy (different words or terms having the same or similar meaning)'. The authors introduce the notions of precision and recall as important features of high-quality textual analysis retrievals. Precision is the number of relevant observations retrieved divided by the total number of observations retrieved, and it captures 'the completeness of search results' (Yang et al., 2018, p. 584). Recall is defined as the

number of relevant observations divided by the total number of relevant observations, and it captures 'the efficiency of results' (Yang et al., 2018, p. 584).

The general call that risk disclosure should be more specific is interpreted in two different ways by academic researchers. First, Hope et al. (2016) define specific risk disclosure as information that contains more specific names, as detected by the named entity recognition technique. Risk information that contains the name of a supplier or the name of the location of a factory is more specific than risk disclosure that does not contain such detailed information. In contrast, Jia et al. (2016) define specific risk disclosure as information that relates to a specific risk category, instead of describing general risk. For them, risk information of high quality would allow risk information to be coded into a certain risk category, instead of being put into the category of general risk. Abraham and Shrives' (2014) interpretation of specific risk information is somewhere in between that of Hope et al. and that of Jia et al. The interpretation of Jia et al. is focused on the risk factor category, while that of Hope et al. (2016) is centred on the description of risk. Abraham and Shrives' interpretation is more subjective and not so easy to classify. They classify risk information as general if it can be applied to any other business. A risk is specific if its disclosure is tailor-made to the company. This distinction is more subjective and is based on the coder's assessment. Overall, there are differences in the way so-called specific risk information is interpreted.

2.5.2. Risk disclosure indices

Madrigal et al. (2015) develop a risk disclosure quantity and quality index. They set up a checklist of 23 items related to risk disclosure, based on eight components of the Committee of Sponsoring Organizations of the Treadway Commission Enterprise Risk Management – Integrated Framework. Madrigal et al. use this checklist in their content analysis to assess the risk information contained in annual reports. A weighted index (Van Staden and Hooks, 2007) is used to rank the information. The risk disclosure index averages the values for the 23 topics identified. The authors then regress their metric on various firm characteristics for a sample of Spanish companies.

Atanasovski et al. (2015) also develop their own risk disclosure index. It is based on the requirements of International Financial Reporting Standards (IFRS) 7, which defines the risk disclosure requirements of financial instruments. A total of 22 disclosure items are identified. The authors point out that it is fairly unlikely that each company is exposed to every one of the risks

identified. Thus, they emphasize that the index should only take applicable disclosures into account. This means that the maximum disclosure score for each company is the number of disclosures applicable to that particular company, and not the total number of disclosure items. The final disclosure index is the firm's disclosure score divided by the maximum number of applicable disclosures.

Shivaani and Agarwal (2020) develop an index for the quality of risk disclosure, combining the quantity of information and the semantic properties of the text. First, the authors take into account whether the risk disclosure provided by the firms contains firm-specific information. Next, the disclosures are categorized based on 59 risk themes taken from the list of Ntim et al. (2013) and adapted to Shivaani and Agarwal's research setting, that is, non-financial Indian listed companies. Finally, the authors consider the semantic properties of the risk themes detected.[7] They distinguish between quality and quantity, which they refer to as nature. They then consider the tense, that is, whether the information is forward or backward looking, and, finally, they consider tone, that is, whether the connotation is good or bad. In addition to the 59 risk themes identified, Shivaani and Agarwal consider 10 items related to risk management, identified by Ntim et al., which they code on a binary scale, that is, disclosed versus not disclosed. The scores of the 59 risk themes, taking into account the semantic properties of the text, and the (binary) scores of the 10 risk management items are summed to form Shivaani and Agarwal's composite risk disclosure index.

The drawback of disclosure indices is that they capture only whether a certain disclosure topic or risk is addressed, but not to what extent, Shivaani and Agarwal (2020) being the exception, since they take the semantic properties of risk disclosure into account. In addition, disclosure indices do not allow for meaningful comparisons between firms. They do not capture whether firms use boilerplate template-like phrases in their risk disclosures. Measures allowing for comparison between firms should be considered. Combining the ideas outlined by the studies described above, an informative measure of risk disclosure should take into account a few characteristics to capture the quality of risk disclosure. First, it should address the risks that firms actually face, and address them extensively. Second, it should be specific to the firms and not

[7] Shivaani and Agarwal (2020) use risk themes as coding units, as opposed to sentences or words.

boilerplate. Third, the metric should consider comparisons with other firms' reports. Fourth, firms should readdress the risks they disclose in the next period's report, to inform investors and other stakeholders if the predicted risk factors occurred or if their chances of occurrence have changed.

2.5.3. Machine learning techniques

Recently, an increasing number of accounting studies have been using machine learning techniques.[8] The first study to apply machine learning to the risk disclosure literature is that of Huang and Li (2011). Huang and Li use a multi-label text classification algorithm, a *supervised* machine learning technique, to classify risk disclosure into 25 risk types. First, the authors identify 25 common risk factor types by reading a sample of U.S. annual reports. Their training set consists of annual reports for the fiscal year 2007, which is the middle year of their sample period, which is from 2006 to 2010. This step requires the subjective judgment of coders. Next, this training set is used to train the author's multi-label categorical K-nearest neighbour algorithm and to subsequently label the risk factor section in the annual reports for the total sample.[9]

Bao and Datta (2014) use a variation of the latent Dirichlet allocation (LDA) topic model of Blei et al. (2003), an *unsupervised* machine learning technique, to group risk factor disclosures from U.S. annual reports into 30 risk factor categories. In contrast to the supervised machine learning technique employed by Huang and Li (2011), the advantage of an unsupervised machine learning algorithm is that the risk types do not have to be predefined (Bao and Datta, 2014). Bao and Datta's (2014) sentence-based LDA (Sent-LDA) model simultaneously discovers and quantifies risk types from the risk disclosures in 10-K forms, which means that the authors first estimate the risk types and then assign the sentences or risk factors to them.

Zhu et al. (2016) adopt the Sent-LDA model developed by Bao and Datta (2014) and adapt it by adding a topic matching algorithm. The authors apply the Sent-LDA model to a dataset of annual reports from 2011 to 2014 and then apply their topic matching algorithm to a dataset of 2015 annual reports to classify the topics detected according to those detected in the 2011–2014

[8] Kearney and Liu (2014), Matthies and Coners (2015), Fisher et al. (2016), Guo et al. (2016), and Loughran and McDonald (2016) present machine learning techniques and show how these techniques are used in the accounting and finance literature.

[9] We abstain from describing the technical details of the algorithms used. The purpose of this section is to give an overview of the studies that use machine learning techniques in the risk disclosure literature, without going into the technical details.

dataset. This approach allows newly detected risk topics from a new set of annual reports to be matched to existing risk topics (Zhu et al., 2016).

Wei et al. (2016) develop a *semi-supervised* machine learning technique called a naïve collision algorithm. Using a training set and a test set of 10-K forms of U.S. commercial banks from 2010 to 2016, Wei et al. combine an unsupervised approach, in their case an automatic collision process, with a supervised approach, that is, human supervision and interpretation. In total, they identify 21 bank risk types from the risk factor section of the annual reports. They report that their proposed algorithm classifies bank risk factors more accurately than the Sent-LDA model.

2.5.4. Opportunities for future research

Future research should focus on the development of an accurate, reliable measure for the quality of risk disclosure. Many risk disclosure studies use different measures for the quantity as well as the quality of risk disclosure. This makes comparisons between results very difficult, and generalization from these studies problematic. Generally, distinctions between the quality and quantity of disclosures can be fuzzy. Thus, either measures should become clearer as to what they measure or researchers should generally abstain from attempting to differentiate between quantity or quality and avoid labelling their measures as such. Rather, researchers should agree on a comprehensive and easily implementable measure for risk disclosure, without attributing the labels of quality or quantity to it.

2.6. Concluding remarks

Risk disclosure has received a considerable amount of attention from regulators, investors, and researchers in recent years. This chapter gives an overview of recent findings in the risk disclosure literature and helps the reader to put the chapters that follow into perspective. Overall, it is worth noting that the literature on risk disclosure has evolved considerably over the last decade, and continues to evolve. For risk disclosure to be useful and informative to its users, it is important to understand its determinants and the motivation of firms reporting this risk information. Another unneglectable aspect that should be discussed and improved is the way in which researchers measure risk disclosure. This literature overview makes it obvious that there is no single universally accepted risk disclosure measure, nor have researchers agreed upon any single

measuring technique. Given the increasing data science literacy of accounting researchers, we expect even more developed techniques to emerge in the literature in the coming years.

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Chapter 3. The effect of business strategy on risk disclosure

3.1. Introduction

This study helps to better understand the factors that determine management's choice of how much risk information to disclose. Over the past decades, researchers have investigated the determinants and incentives of how much and what risk information firms reveal (Elshandidy et al., 2018). Corporate size, the leverage ratio, profitability and risk factors have been found to be determinants of risk disclosure (Khlif and Hussainey, 2016). Other, more subtle factors play a role too. Recent studies revealed that cultural factors seem to play a role (Dobler et al., 2016). Dobler et al. (2016) find that most of Hofstede's (2001) cultural values, namely, power distance, uncertainty avoidance, individualism, and long-term orientation, are determinants of risk disclosure, if controlling for the legal system. Further, Ríos-Figueroa (2016) finds that economic and political factors should not be neglected; the control of corruption and regulation quality positively affect the level of risk disclosure. Since previous studies show that a firm's business strategy shapes its information environment (Bentley-Goode et al., 2019), we investigate whether this business strategy is one of the more subtle factors influencing the amount of risk information firms reveal.

This study focuses on listed European Economic Area (EEA) companies. These companies prepare their annual financial statements according to International Financial Reporting Standards (IFRS), and IFRS 7 requires firms to provide in their financial statements a description of the qualitative and quantitative nature of the risks arising from financial instruments. Further, the International Accounting Standards Board (2010) issued an IFRS Practice Statement presenting a framework for management commentary that should include information on the firm's risk exposure. However, the Practice Statement is a recommendation only, and not mandatory. At the

European Union (EU) level, Directive 2013/34/EU[10] provides details on the mandatory management report. A firm's management report should describe in the annual financial statements the principal risks and uncertainties that the firm faces. Risk disclosure in the EU and its quasi-voluntary (Dobler et al., 2011) or quasi-mandatory nature (Mazumder and Hossain, 2018) give managers discretion on the amount of risk information to reveal in the annual report.

Using a sample of 2,344 non-financial and non-utility firms from 30 EEA countries, we analyse whether business strategy, using the measure of Bentley et al. (2013) and the definition of Miles and Snow (1978, 2003), is a determinant of risk disclosure in the annual report, as measured by the natural logarithm of the number of risk-related sentences in the annual report. Miles and Snow (1978, 2003) define three types of business strategies; defenders, prospectors, and analysers. Miles and Snows' defenders are characterized by a stable organizational structure with a narrow product focus (Bentley et al., 2013; Higgins et al., 2015). These firms compete on prices, service, and quality. In contrast, prospectors have a flexible organizational structure that allows them to adapt quickly to product mix. These firms compete for innovative market leadership (Bentley et al., 2013; Higgins et al., 2015). Analysers use hybrid strategies and incorporate the characteristics of both defenders and analysers (Miles and Snow, 1978, 2003).

Previous studies find that firms adopting a prospector strategy are more likely to provide voluntary disclosure (Bentley-Goode at al., 2019). Lim et al. (2018) find that business strategy is a determinant of the complexity of annual reports. They find that prospector firms use more complex language in their annual reports than defender firms. They also find that prospectors' annual reports have a more negative tone than defenders'. In addition, the authors find that prospectors' annual reports include more words related to uncertainty. We complement these studies by analysing and finding that business strategy is a determinant of a firm's risk disclosures. Thus, we provide further evidence of the influence of a firm's business strategy on its disclosure behaviour. More precisely, we find that prospectors are more likely to reveal risk information in their annual report than defenders. We argue that this is because, first, firms adopting a prospector strategy have a business model that is typically characterized by more uncertainty (Bentley-Goode et al., 2019; Hsieh et al., 2019). In addition, prospectors engage in risky projects (Lim et al., 2018;

[10] Directive 2013/34/EU was amended by Directive 2014/95/EU.

Rajagopalan, 1997). Thus, these firms should report and inform stakeholders about risk factors in the annual report accordingly. Second, according to organizational theory, prospectors reveal more voluntary information (Bentley-Goode et al., 2019). Because of its quasi-voluntary or quasi-mandatory nature, we expect this to hold for risk disclosure as well.

Our study makes several contributions. First, it contributes to the risk disclosure literature by increasing our understanding of the determinants of risk disclosure. Second, it adds to the growing body of risk disclosure studies within the European setting. Large-sample evidence of the risk disclosure behaviour of European firms is very limited, mainly because of the time-consuming and often manual collection of annual reports.[11] Third, to the best of our knowledge, this is the first study to implement the business strategy measure of Bentley et al. (2013) on a European sample. Our descriptive statistics show that the business strategies of the firms in our sample are largely in line with those of U.S. firms. However, in contrast to previous studies in the U.S. setting, where samples typically count more prospectors than defenders (Bentley et al., 2013; Bentley-Goode et al., 2019; Higgins et al., 2015; Navissi et al., 2017), our sample counts more defenders than prospectors. This could suggest that European firms are less innovative than U.S. firms and that they drift more toward the defender side of the business strategy spectrum than the prospector side.

This paper proceeds as follows. Section 3.2 reviews the business strategy literature and presents our hypothesis. Section 3.3 describes our research design, with definitions of the variables. Section 3.4 reports the main findings, including robustness checks. Section 3.5 presents additional analysis. Section 3.6 concludes the study.

3.2. Literature review and hypothesis development

3.2.1. Literature review

A firm's business strategy influences its operating complexity and its environmental uncertainty (Bentley et al., 2013; Lim et al., 2018). Prospectors adopt an innovation-oriented strategy and thus constantly search new business opportunities, whereas defenders focus on establishing a leadership position in their existing business (Hsieh et al., 2019; Miles and Snow,

[11] This is in sharp contrast to the availability of U.S. companies' annual report. The U.S. Security and Exchange Commission (SEC) requires firms to file their annual report under a specific form, 10-K. These 10-K forms are made available to the public by the SEC through EDGAR, their search platform. Thus, it is comparably easy to access and download large numbers of annual reports for the U.S. context.

1978, 2003). Further, a firm's business strategy influences its information environment (Bentley-Goode et al., 2019). Bentley-Goode et al. (2019) suggest that prospectors issue more press releases and management earnings guidance. In addition, they find that analysts cover more prospectors than defenders. Khedmati et al. (2019) find a relation between business strategy and the cost of equity capital. They show that investors demand lower rates of return when investing in prospectors or defenders than they do when investing in analyser firms. Guo (2017) suggests that business strategy influences the magnitude of intra-industry information transfer between firms. Information transfers are stronger if the announcing firm adopts a prospector strategy, and weaker if the receiving peer company is a prospector, since prospectors' market value is weakly correlated with overall industry trends (Guo, 2017).

Further, a firm's business strategy influences its business and strategic decisions. Higgins et al. (2015) find that firms with a prospector strategy are more likely to engage in tax avoidance than firms with a defender strategy. Chen and Jermias (2014) find that business strategy impacts the use of performance-linked compensation. Cinquini and Tenucci (2010) link business strategy to strategic management accounting: in line with their cost leadership strategy, defenders are more likely to use costing techniques. Maniora (2018) analyses the relation between business strategy and the mismanagement of sustainability issues and reveals that prospectors are more likely than defenders to intentionally mismanage sustainability issues.

Previous evidence of how business strategy influences firms' disclosure behaviour is limited. Lim et al. (2018) find that prospectors' annual reports have a more negative tone than that of defenders. In addition, they find that prospectors' annual reports include more words related to uncertainty, confirming that the environment of prospectors is more volatile and risky compared to defenders, as reflected in their annual reports.

3.2.2. Hypothesis development

We expect firms that adopt an innovation-oriented prospector strategy to be more likely to communicate information on their risk factors in the annual report through two channels. First, the business activities of prospectors are characterized by high levels of innovation and research and development, which are typically riskier (Lim et al., 2018). In addition, prospectors typically invest in risky projects (Rajagopalan, 1997) and even tend to overinvest in risky but high-return projects

(Navissi et al., 2017). Since prospectors typically focus on risky and innovative projects, they are exposed to greater uncertainty (Bentley-Goode et al., 2019). Prospectors face greater ambiguity, and hence greater non-probabilistic uncertainty (Hsieh et al., 2019). Because of the innovative nature of a prospector strategy, cause and effect relations are less known and more unpredictable for firms choosing a prospector strategy than for firms adopting a defender strategy (Hsieh et al., 2019). The annual report should reflect this; prospectors should report their risky investments, projects, and business activities accordingly. On the contrary, efficiency-oriented defender firms adopt a less risky and uncertain business strategy (Lim et al., 2018) and, thus, we expect these firms to reveal less information on risk factors.

Second, according to organizational theory, prospectors engage in greater voluntary disclosure (Bentley-Goode et al., 2019). Prospectors have more incentives to reveal information voluntarily because they have greater agency costs, rely more on external financing, tend to be less profitable, and place more emphasis on brand-building marketing strategies than defenders (Bentley-Goode et al., 2019). Since, within our study setting, risk disclosure is mandatory but guidance on how and what to report about risk factors is scant, managers have a high degree of flexibility and discretion on how to report their risk factors. Thus, we expect firms adopting an innovation-oriented prospector strategy to reveal more risk information.

Based on the arguments above, we hypothesize that prospectors are more likely to reveal risk information and to have extensive risk disclosures.

3.3. Research design

To test our hypothesis, we estimate the following ordinary least squares (OLS) model:

$$\begin{aligned} RiskDisclosure_{i,t} = {} & \beta_0 + \beta_1 BusinessStrategy_{i,t} + \beta_2 FirmSize_{i,t} + \beta_3 Leverage_{i,t} \\ & + \beta_4 Profitability_{i,t} + \beta_5 Loss_{i,t} + \beta_6 HistoricBeta_{i,t} \\ & + \beta_7 HistoricVolatility_{i,t} + \beta_8 TradingVolume_{i,t} + \beta_9 CrossListing_{i,t} \\ & + \beta_{10} YearDummies + \beta_{11} IndustryDummies + \beta_{12} CountryDummies + \varepsilon_{i,t} \end{aligned}$$

3.3.1. Dependent variable

We download the annual reports of 2,344 non-financial and non-utility firms from 30 countries[12] comprising the EEA from Thomson Reuters Eikon. The downloaded Acrobat files were converted into text files for text extraction. In a first step, the extracted texts were cleaned. The texts were split into sentences before the cleaning rules were applied. Only sentences that contained at least 50% letters, with less than 20% non-alphanumeric characters, and at least 30 letters with fewer than 30 digits were retained (Lang and Stice-Lawrence, 2015). We used the English version of the annual reports published by the firms. Previous studies show that the annual report in the native language conveys the same information as in English (Campbell et al., 2005; Zreik and Louhichi, 2017).

Our dependent variable, *RiskDisclosure*, is the natural logarithm of the number of risk-related sentences in the annual report. A sentence is classified as risk related if it contains at least one risk keyword from the list developed by Elshandidy et al. (2013).[13] Using sentences as coding units instead of words avoids counting the same information or idea twice (Abraham and Cox, 2007; Abraham and Shrives, 2014; Dobler et al., 2011; Kravet and Muslu, 2013; Linsley and Shrives, 2006). Further, consistent with Elshandidy et al. (2013) and Kothari et al. (2009), we do not limit our study to a specific section of the annual report but, rather, analyse the annual report as a whole.

3.3.2. Independent variable of interest

The independent variable of interest in our model is the firm business strategy. We use the measure of business strategy of Bentley et al. (2013), which relies on Miles and Snow's (1978, 2003) definition of defenders, analysers, and prospectors. The measures are formed by computing six variables: (1) the ratio of research and development expenses to sales, (2) the ratio of the number of employees to sales, (3) the one-year percentage change in sales, (4) the ratio of selling, general, and administrative expenses to sales, (5) the standard deviation of the number of employees, and (6) the ratio of net property, plant, and equipment to total assets. These six

[12] We include all 28 EU member states and two countries, namely, Iceland and Norway, of the European Free Trade Association. Lichtenstein is not included in the final sample owing to data unavailability.

[13] The word list developed by Elshandidy et al. (2013) contains the following terms, where an asterisk denotes word derivatives: *risk*, loss*, decline* (*declined*), *decrease* (*decreased*), *less, low*, fail* (*failure*), *threat, verse* (*versed; reverse; reversed*), *viable, against, catastrophe* (*catastrophic*), *shortage, unable, challenge* (*challenges*), *uncertain* (*uncertainty; uncertainties*), *gain* (*gains*), *chance* (*chances*), *increase* (*increased*), *peak* (*peaked*), *fluctuate*, differ*, diversify*, probable**, and *significant**.

variables are proxies for a firm's (1) investment in the development of new products, (2) production and distribution efficiency, (3) overall investments, (4) marketing expenses for product market opportunities, (5) managerial stability, and (6) capital intensity (Bentley et al., 2013; Bentley-Goode et al., 2019). The values of these variables are expected to be higher for prospectors, except capital intensity, which is expected to be higher for defenders.

All six variables are computed using the average over a rolling five-year window, since business strategies are stable over time (Bentley et al., 2013; Hambrick, 1983; Snow and Hambrick, 1980). Next, the six variables are ranked into quintiles by year and by industry.[14] All firm–year observations are attributed a value between one and five, based on their quintile rank.[15] The quintile ranks are added up, which results in a single measure ranging between six and 30, which is our independent variable of interest, *BusinessStrategy*. Defenders and prospectors are on both ends of the spectrum of *BusinessStrategy*, with defenders characterized by values between six and 12, prospectors by values between 24 and 30, and analysers by values between 13 and 23. Consistent with previous studies (Bentley et al., 2013; Bentley-Goode et al., 2019; Higgins et al., 2015; Lim et al., 2018; Navissi et al., 2017), we focus on the two ends of the spectrum, that is, defenders and prospectors, and use analysers as the benchmark.

3.3.3. Control variables

All the control variables were obtained from Thomson Reuters Eikon's Datastream[16] and are as follows: *FirmSize* is the natural logarithm of total assets for the financial year (Elshandidy and Neri, 2015); *Leverage* is short- and long-term debt, divided by the common equity of the firm (Elshandidy and Shrives, 2016); and *Profitability* is the return on assets (Khlif and Hussainey, 2016; Miihkinen, 2012). A firm's size and its leverage ratio and profitability have proven to be determinants of its risk reporting (Khlif and Hussainey, 2016). The variable *Loss* is a dummy variable taking the value of one if the firm reported a negative income for the financial year, and zero otherwise (Kravet and Muslu, 2013); *HistoricBeta* is the average beta coefficient from the regression of the firm's stock return on the market return over the last five years (Miihkinen, 2012);

[14] Consistent with Bentley et al. (2013), we use two-digit Standard Industrial Classification (SIC) codes for industry classification.
[15] A score of five is given if the firm–year observation is within the fifth quintile, and a score of one is given if the firm–year observation is within the first quintile, except for capital intensity. Capital intensity is reverse scored.
[16] Appendix A provides more details on all the variables, including the control variables, in our regression analysis.

and *HistoricVolatility* is the average volatility of stock returns over the last five years. Firms that are riskier are expected to reveal more risk information (Elshandidy and Neri, 2015). The variable *TradingVolume* is the trading volume divided by the number of shares, and *CrossListing* is a dummy variable taking the value of one if the firm is cross listed on a U.S. exchange, and zero otherwise. Miihkinen (2012) finds that a foreign listing status is an important determinant of risk disclosure.

3.4. Main empirical findings

3.4.1. Descriptive statistics

Table 3.1 shows descriptive statistics for all the variables in our main regression model. The table shows statistics for the full sample and for prospectors, defenders, and analysers separately. The full sample consists of 12,065 firm–year observations, of which 656 are prospector firm–year observations and 1,290 are defender firm–year observations. For our dependent variable *RiskDisclosure*, we show descriptive statistics for its natural logarithmic transformation and for the raw measure, that is, the sentence count. On average, over the sample period, firms published around 253 risk-related sentences in their annual report. Prospectors, on average, engaged in more risk disclosure than defenders. The variable *BusinessStrategy* has an average value of 17.108 and a median value of 17. This result is largely in line with previous studies (Bentley et al., 2013; Bentley-Goode et al., 2019; Hsieh et al., 2019; Lim et al., 2018) that show mean and median values of around 18. Consistent with previous studies on U.S. companies (Bentley et al., 2013; Bentley-Goode et al., 2019), firms adopting a prospector strategy are less profitable than firms adopting a defender strategy, as shown by the lower levels for *Profitability* and *Loss*. Consistent with the results of Hsieh et al. (2019), prospectors show lower levels for *Leverage*. Further, prospectors have higher values for *HistoricBeta*, *HistoricVolatility* and *TradingVolume* than defenders, suggesting that prospectors face higher risks. Cross-listing on a U.S. stock exchange is more common for firms adopting a prospector strategy.

Table 3.1: Descriptive statistics

	Full Sample (N = 12,065)					Prospectors (N = 656)		Defenders (N = 1,290)		Analysers (N = 10,119)	
	Mean	St. dev.	p25	Median	p75	Mean	Median	Mean	Median	Mean	Median
RiskDisclosure	5.319	.691	4.92	5.366	5.799	5.241	5.283	5.134	5.187	5.348	5.394
	252.593	*161.394*	*137*	*214*	*330*	*236.828*	*197*	*208.163*	*179*	*259.279*	*220*
BusinessStrategy	17.108	3.779	14	17	20	25.055	25	10.912	11	17.383	17
FirmSize	12.804	2.234	11.243	12.737	14.335	11.813	11.387	12.425	12.183	12.916	12.843
Leverage	.185	.386	.006	.069	.221	.102	.009	.228	.078	.185	.072
Profitability	2.816	13.958	1.05	4.95	8.79	-11.727	-2.61	4.115	4.585	3.593	5.14
Loss	.242	.428	0	0	0	.543	1	.223	0	.224	0
HistoricBeta	.852	.497	.51	.795	1.15	.99	.94	.773	.72	.854	.8
HistoricVolatility	.407	.18	.276	.368	.496	.522	.492	.381	.349	.403	.366
TradingVolume	.668	1.022	.118	.352	.769	.839	.441	.546	.238	.672	.362
CrossListing	.133	.339	0	0	0	.18	0	.048	0	.141	0

This table reports descriptive statistics for the dependent variable, *RiskDisclosure*; the independent variable of interest, *BusinessStrategy*; and the control variables employed in our main regression analysis. For *RiskDisclosure*, we report descriptive statistics for the natural logarithmic transformation and for the raw count values (in italics). See Appendix A for variable definitions.

Table 3.2: Descriptive statistics

Panel A: Risk disclosure and business strategy, by industry					
Industry	Two-digit SIC codes	N	*RiskDisclosure*	*RiskDisclosure* (raw)	*BusinessStrategy*
Agriculture, Forestry, and Fishing	01–09	139	5.157	198.683	16.007
Mining	10–14	588	5.583	330.714	16.199
Construction	15–17	479	5.427	276.833	16.232
Manufacturing	20–39	5686	5.382	266.871	17.723
Transportations and Communications Services	40–48	883	5.517	304.853	16.320
Wholesale Trade	50–51	500	5.288	241.738	16.468
Retail Trade	52–59	791	5.283	233.886	15.731
Services	70–89	2999	5.097	200.189	17.014
Panel B: Risk disclosure and business strategy, by year					
Year		N	*RiskDisclosure*	*RiskDisclosure* (raw)	*BusinessStrategy*
2005		288	4.881	171.094	17.931
2006		813	4.791	152.973	16.777
2007		859	4.974	176.700	16.809
2008		947	5.127	203.546	16.835
2009		1023	5.226	224.475	17.005
2010		1073	5.252	231.866	17.095
2011		1105	5.307	242.641	17.102
2012		1024	5.326	248.859	17.225
2013		1024	5.416	270.987	17.329
2014		1065	5.500	293.431	17.242
2015		1001	5.566	307.798	17.196
2016		1006	5.616	321.604	17.146
2017		837	5.766	365.992	17.183

This table reports descriptive statistics for our dependent variable, *RiskDisclosure* (natural logarithmic transformation and raw count values), and our independent variable of interest, *BusinessStrategy*, by industry (Panel A) and by year (Panel B). See Appendix A for variable definitions.

Table 3.2 shows the mean values of the dependent variable *RiskDisclosure* and the independent variable of interest, *BusinessStrategy*, by industry (Panel A) and by year (Panel B).[17] The manufacturing industry, followed by the services industry, counts the most firm–year observations in our sample. Firms from the mining industry reveal, on average, the most risk information in their annual reports over the sample period. Firms from the agriculture, forestry, and fishing industry reveal the least risk information. The mean values of *BusinessStrategy* across industries do not vary much; the average firm across all industries can be classified as an analyser. Panel B shows the mean values of *RiskDisclosure* and *BusinessStrategy* by year. The amount of risk information in the annual report more than doubles over the sample period; in 2005, the average number of risk-related sentences in the annual report was 171.094, whereas this number doubled to 365.992 in 2017. Figure 3.1 illustrates the increase in *RiskDisclosure* over the sample period. The mean value of *BusinessStrategy* remains relatively stable across the sample period.

Figure 3.1: Risk disclosure by industry over the sample period, 2005–2017

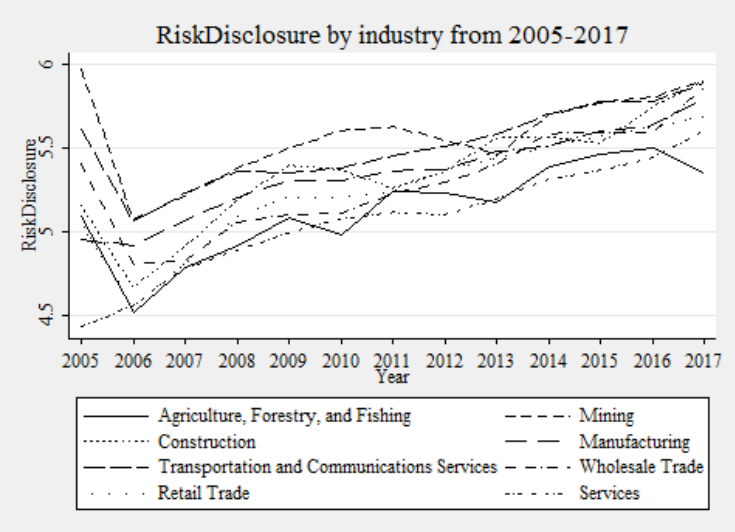

Table 3.3 shows the pairwise correlations of the variables in the main regression analysis. The variable *BusinessStrategy* is positively and significantly correlated with *RiskDisclosure*. The positive correlation suggests that firms adopting a prospector strategy are associated with a higher level of risk disclosure.

[17] Appendix B shows the mean values of *RiskDisclosure* and *BusinessStrategy* by country.

Table 3.3: Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) *RiskDisclosure*	1.000									
(2) *BusinessStrategy*	0.095*	1.000								
(3) *FirmSize*	0.711*	0.008	1.000							
(4) *Leverage*	0.041*	-0.094*	0.083*	1.000						
(5) *Profitability*	0.139*	-0.175*	0.305*	-0.036*	1.000					
(6) *Loss*	-0.143*	0.094*	-0.293*	0.095*	-0.668*	1.000				
(7) *HistoricBeta*	0.205*	0.096*	0.221*	0.017	-0.072*	0.079*	1.000			
(8) *HistoricVolatility*	-0.266*	0.129*	-0.417*	0.005	-0.361*	0.373*	0.421*	1.000		
(9) *TradingVolume*	0.120*	0.078*	0.190*	-0.015	0.031*	-0.008	0.184*	0.053*	1.000	
(10) *CrossListing*	0.329*	0.145*	0.419*	-0.027*	0.053*	-0.058*	0.112*	-0.112*	0.141*	1.000

This table reports Pearson's correlations for the dependent variable, the independent variable of interest, and the control variables in our main regression analysis. See Appendix A for variable definitions. * indicates significance at the 1% level.

3.4.2. Regression results

Table 3.4 shows the estimation results from our risk disclosure model. Year, industry, and country dummies are included in the models. Standard errors are Huber–White heteroskedastic and clustered by firm. All continuous variables are winsorized at the first and 99th percentiles.

Table 3.4: Risk disclosure and business strategy: Main analysis

	(1)	(2)	(3)
Dependent variable	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*
VARIABLES	Full sample	Full sample	Defenders and prospectors only
BusinessStrategy	0.00823***		
	(3.847)		
Defender		-0.0659***	
		(-2.930)	
Prospector		0.0498*	0.113***
		(1.771)	(2.782)
FirmSize	0.200***	0.200***	0.189***
	(37.20)	(37.28)	(17.92)
Leverage	-0.0116	-0.0146	0.00618
	(-0.730)	(-0.918)	(0.168)
Profitability	-0.00146***	-0.00162***	-0.000681
	(-2.618)	(-2.875)	(-0.614)
Loss	0.0555***	0.0537***	0.0972**
	(3.256)	(3.146)	(2.336)
HistoricBeta	0.0873***	0.0875***	0.113***
	(5.594)	(5.618)	(3.392)
HistoricVolatility	-0.0132	-0.00474	-0.0836
	(-0.243)	(-0.0876)	(-0.781)
TradingVolume	0.0223***	0.0234***	0.0130
	(3.907)	(4.098)	(1.378)
CrossListing	0.0717***	0.0779***	0.128**
	(2.750)	(2.994)	(2.340)
Constant	2.300***	2.439***	2.508***
	(19.81)	(22.33)	(12.51)
Observations	12,065	12,065	1,946
Adjusted R^2	0.620	0.620	0.612
Year dummies	YES	YES	YES
Industry dummies	YES	YES	YES
Country dummies	YES	YES	YES

This table reports the results from the OLS regressions of business strategy on risk disclosure. In specification (1), the independent variable is the business strategy measure of Bentley et al. (2013). In specification (2), we include the two dummy variables *Prospector* and *Defender*. In specification (3), we limit the sample to prospector and defender firm–year observations. See Appendix A for variable definitions. Continuous variables are winsorized at the first and 99th percentiles. The *t*-statistics are reported in parentheses. Standard errors are heteroscedasticity robust and clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

In column (1) of Table 3.4, the independent variable of interest is *BusinessStrategy*. The coefficient on *BusinessStrategy* is positive and significant at the 1% level (coeff. = 0.00863, *t*-stat. = 3.847) suggesting that a firm's business strategy is a determinant of its risk disclosure. In addition, the positive coefficient suggests that firms adopting a prospector strategy are more likely to engage in risk disclosure. To analyse this further, in column (2) we include *Defender*, a dummy variable taking the value of one if a firm's *BusinessStrategy* scores between six and 12, and zero otherwise, and *Prospector*, a dummy variable taking the value of one if a firm's *BusinessStrategy* scores between 24 and 30, and zero otherwise. The coefficient on *Defender* is negative and significant at the 1% level (coeff. = -0.0659, *t*-stat. = -2.930), while the coefficient on *Prospector* is positive and significant at the 10% level (coeff. = 0.0498, *t*-stat. = 1.771). We perform an F-test of the equality of the coefficients of *Defender* and *Prospector*. We reject the null hypothesis that the two coefficients are equal (*F*-stat. = 10.48, *p*-value = 0.0012). Defenders (prospectors) are less (more) likely to reveal risk information in the annual report. In column (3), we limit our sample to defender and prospector firm–year observations (Higgins et al., 2015; Lim et al., 2018), which results in 1,946 firm–year observations for the estimation of our risk disclosure model. The coefficient on *Prospector* is positive and significant at the 1 % level (coeff. = 0.113, *t*-stat. = 2.782), confirming that prospectors disclose more risk information in their annual reports relative to defenders.

The results show that the size of the firm (*FirmSize*), whether the firm recorded a loss for the financial year (*Loss*), the firm's risk profile (*HistoricBeta* and *TradingVolume*), and whether the firm is cross listed on a U.S. stock exchange (*CrossListing*) positively and significantly influences the amount of risk information revealed in the annual report. The profitability of the firm (*Profitability*) negatively influences *RiskDisclosure*.

3.4.3. Robustness test

3.4.3.1. Endogeneity

To tackle endogeneity concerns, we re-estimate our risk disclosure model, lagging all the independent and control variables (Lim et al., 2018). Table 3.5 shows the results for the lead–lag estimation.

Table 3.5: Risk disclosure and business strategy: lead-lag estimation

	(1)	(2)	(3)
Dependent variable	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*
VARIABLES	Full sample	Full sample	Defenders and prospectors only
BusinessStrategy	0.00864***		
	(3.782)		
Defender		-0.0736***	
		(-3.028)	
Prospector		0.0374	0.0957**
		(1.194)	(2.016)
FirmSize	0.196***	0.196***	0.182***
	(34.02)	(34.11)	(15.88)
Leverage	-0.0110	-0.0152	0.00759
	(-0.621)	(-0.858)	(0.158)
Profitability	-0.00142**	-0.00164**	-0.00110
	(-2.175)	(-2.464)	(-0.829)
Loss	0.0455**	0.0437**	0.0851**
	(2.540)	(2.438)	(1.981)
HistoricBeta	0.0901***	0.0906***	0.0985***
	(5.240)	(5.275)	(2.814)
HistoricVolatility	-0.0687	-0.0587	-0.0768
	(-1.122)	(-0.965)	(-0.715)
TradingVolume	0.0238***	0.0251***	0.0141
	(3.885)	(4.070)	(1.292)
CrossListing	0.0650**	0.0718***	0.148**
	(2.445)	(2.712)	(2.547)
Constant	2.494***	2.645***	2.608***
	(19.52)	(22.09)	(11.91)
Observations	9,153	9,153	1,468
Adjusted R^2	0.629	0.628	0.596
Year dummies	YES	YES	YES
Industry dummies	YES	YES	YES
Country dummies	YES	YES	YES

This table addresses endogeneity concerns. We use OLS regression estimates with one-year lags of our independent variable of interest and of our control variables to handle any reverse causality concerns. In specification (1), the independent variable is the business strategy measure of Bentley et al. (2013). In specification (2), we include the dummy variables *Prospector* and *Defender*. In specification (3), we limit the sample to prospector and defender firm–year observations. See Appendix A for variable definitions. Continuous variables are winsorized at the first and 99th percentiles. The *t*-statistics are reported in parentheses. Standard errors are heteroscedasticity robust and clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Column (1) of Table 3.5 confirms the results of Table 3.4; the coefficient on *BusinessStrategy* is positive and significant at the 1% level (coeff. = 0.00864, *t*-stat. = 3.782). In column (2), we include the dummy variables *Defender* and *Prospector*. The coefficient on lagged *Defender* is

negative and significant at the 1% level (coeff. = -0.0736, *t*-stat. = -3.028). The coefficient on lagged *Prospector* is positive but not significant (coeff. = 0.0374, *t*-stat. = 1.194). In column (3), we limit the sample to defender and prospector firm–year observations and find a positive and significant coefficient for the lagged *Prospector* variable at the 5% level (coeff. = 0.0957, *t*-stat. = 2.016). Overall, the results of our lead–lag estimation indicate that reverse causality is not a concern in our risk disclosure model.

3.4.3.2. Alternative risk disclosure measures

We re-estimate our risk disclosure model using an alternative measure for *RiskDisclosure*, namely, the number of risk keywords by Elshandidy et al. (2013) in the annual report. We use the natural logarithm of the keyword count for the regression estimation. Specifications (1) to (3) in Table 3.6 report the results. The results are in line with those in our main Table 3.4, suggesting that the results are robust to an alternative risk disclosure measure.

Table 3.6: Risk disclosure and business strategy: Alternative risk disclosure measures

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*	*Relative RiskDisclosure*	*Relative RiskDisclosure*	*Relative RiskDisclosure*
VARIABLES	Full sample	Full sample	Defenders and prospectors only	Full sample	Full sample	Defenders and prospectors only
BusinessStrategy	0.00876***			-0.000142		
	(3.988)			(-0.880)		
Defender		-0.0689***			-0.000227	
		(-2.998)			(-0.137)	
Prospector		0.0515*	0.120***		-0.00410*	-0.00211
		(1.787)	(2.885)		(-1.811)	(-0.617)
FirmSize	0.202***	0.202***	0.192***	-3.50e-05	-7.47e-05	-0.000156
	(36.20)	(36.25)	(17.28)	(-0.0849)	(-0.181)	(-0.184)
Leverage	-0.0128	-0.0161	0.0104	0.00373***	0.00374***	0.00753***
	(-0.787)	(-0.986)	(0.283)	(3.106)	(3.115)	(2.677)
Profitability	-0.00148**	-0.00166***	-0.000783	-3.19e-05	-3.96e-05	0.000109
	(-2.575)	(-2.847)	(-0.694)	(-0.699)	(-0.868)	(1.058)
Loss	0.0593***	0.0574***	0.0970**	0.00349***	0.00352***	0.00236
	(3.349)	(3.236)	(2.268)	(2.680)	(2.702)	(0.770)
HistoricBeta	0.0895***	0.0897***	0.110***	-0.00154	-0.00149	-0.00183
	(5.541)	(5.566)	(3.213)	(-1.200)	(-1.164)	(-0.693)
HistoricVolatility	-0.00114	0.00822	-0.0457	0.0127***	0.0125***	0.0226***
	(-0.0202)	(0.147)	(-0.421)	(3.035)	(3.007)	(2.880)
TradingVolume	0.0196***	0.0208***	0.00993	-0.000712	-0.000700	-0.000599
	(3.410)	(3.607)	(1.034)	(-1.439)	(-1.415)	(-0.694)
CrossListing	0.0764***	0.0831***	0.137**	0.000971	0.000909	0.000960
	(2.860)	(3.120)	(2.444)	(0.533)	(0.502)	(0.287)
Constant	2.569***	2.717***	2.768***	0.202***	0.200***	0.210***
	(21.28)	(23.78)	(13.43)	(20.66)	(21.37)	(11.07)
Observations	12,065	12,065	1,946	12,065	12,065	1,946
Adjusted R^2	0.607	0.606	0.605	0.298	0.298	0.285
Year dummies	YES	YES	YES	YES	YES	YES

Industry dummies	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES

This table reports the results from the OLS regressions of business strategy on risk disclosure, with alternative measures for *RiskDisclosure*. In specifications (1) to (3), we use the natural logarithm of the number of risk keywords of Elshandidy et al. (2013) in the annual report. In specifications (4) to (6), we use relative *RiskDisclosure*, which is our main risk disclosure variable, divided by the total number of sentences in the annual report. In specifications (1) and (4), the independent variable is the business strategy measure of Bentley et al. (2013). In specifications (2) and (5), we include the two dummy variables *Prospector* and *Defender*. In specifications (3) and (6), we limit the sample to prospector and defender firm–year observations. See Appendix A for variable definitions. Continuous variables are winsorized at the first and 99th percentiles. The *t*-statistics are reported in parentheses. Standard errors are heteroscedasticity robust and clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

In specifications (4) to (6) of Table 3.6, we rerun our main regression using the relative amount of risk disclosure in the annual report. We measure relative risk disclosure by the number of risk-related sentences in the annual report, divided by the total number of sentences in the annual report. Our results suggest that business strategy is not a determinant of the relative amount of risk information revealed in the annual report. This result suggests that business strategy is a determinant of the absolute amount of risk disclosure and does not seem to affect the amount of risk information in relation to the total information revealed.

3.4.3.3. Country characteristics

We re-estimate our main model and include country-specific characteristics instead of country dummies. We include the dummy variable *CommonLaw*, which takes the value of one for the United Kingdom and Ireland, and zero for all other countries; *CivilLaw* is a dummy variable taking the value of one for Austria, Belgium, Bulgaria, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden, and zero for all other countries. Cyprus and Malta are considered mixed law countries. We further include Hofstede's (2001) cultural values – *PowerDistance*, *Individualism*, *Masculinity*, *UncertaintyAvoidance*, *LongTermOrientation*, and *Indulgence* – for all countries, since they have been found to be determinants of a firm's risk disclosure (Dobler et al., 2016; Elshandidy et al., 2015).

Table 3.7: Risk disclosure and business strategy: Country characteristics

	(1)	(2)	(3)
Dependent variable	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*
VARIABLES	Full sample	Full sample	Defenders and prospectors only
BusinessStrategy	0.00934***		
	(4.341)		
Defender		-0.0760***	
		(-3.305)	
Prospector		0.0515*	0.127***
		(1.839)	(3.246)
FirmSize	0.199***	0.199***	0.183***
	(37.54)	(37.59)	(18.00)
Leverage	-0.00752	-0.0114	0.00477
	(-0.451)	(-0.681)	(0.123)

Profitability	-0.00147***	-0.00168***	-8.57e-05
	(-2.607)	(-2.949)	(-0.0754)
Loss	0.0555***	0.0534***	0.112***
	(3.188)	(3.063)	(2.636)
HistoricBeta	0.0911***	0.0913***	0.135***
	(5.672)	(5.698)	(3.694)
HistoricVolatility	-0.0415	-0.0319	-0.155
	(-0.732)	(-0.565)	(-1.354)
TradingVolume	0.0193***	0.0204***	0.0198**
	(3.343)	(3.528)	(2.069)
CrossListing	0.0746***	0.0816***	0.125**
	(2.791)	(3.060)	(2.200)
CommonLaw	0.0667	0.0661	1.141**
	(0.357)	(0.356)	(2.248)
CivilLaw	0.111	0.119	1.119**
	(0.653)	(0.705)	(2.558)
PowerDistance	-0.00337**	-0.00333**	-0.000564
	(-2.114)	(-2.100)	(-0.301)
Individualism	0.000944	0.000916	-0.000633
	(0.660)	(0.639)	(-0.267)
Masculinity	-0.000350	-0.000229	-0.00268
	(-0.280)	(-0.183)	(-1.250)
UncertaintyAvoidance	-0.000898	-0.000995	-0.00273*
	(-0.599)	(-0.668)	(-1.950)
LongTermOrientation	0.00236**	0.00242**	0.00518**
	(2.484)	(2.540)	(2.445)
Indulgence	-0.00461***	-0.00441***	-0.00573*
	(-3.228)	(-3.072)	(-1.838)
Constant	2.237***	2.369***	1.645***
	(9.194)	(9.806)	(4.325)
Observations	12,065	12,065	1,946
Adjusted R^2	0.603	0.602	0.590
Year dummies	YES	YES	YES
Industry dummies	YES	YES	YES
Country dummies	NO	NO	NO

This table reports the results from the OLS regressions of business strategy on risk disclosure, including country-specific characteristics instead of country dummies. We include the two dummy variables *CommonLaw* and *CivilLaw*, two proxies for the country's legal system, and variables for Hofstede's (2001) cultural values to account for cultural differences between countries. In specification (1), the independent variable is the business strategy measure of Bentley et al. (2013). In specification (2), we include the two dummy variables *Prospector* and *Defender*. In specification (3), we limit the sample to prospector and defender firm–year observations. See Appendix A for variable definitions. Continuous variables are winsorized at the first and 99th percentiles. The *t*-statistics are reported in parentheses. Standard errors are heteroscedasticity robust and clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 3.7 reports the results. Our main inferences remain unchanged: business strategy is a determinant of risk disclosure, and prospectors are more likely than defenders to report their risk factors. Our results further show that the legal system does not seem to play a role. In specifications

(1) and (2), neither *CommonLaw* nor *CivilLaw* is significant. However, in specification (3), where we limit our sample to prospectors and defenders, both show a positive and significant coefficient. The variables *PowerDistance* and *Indulgence* seem to be negative determinants of risk disclosure, and *LongTermOrientation* is shown to be a positive determinant of risk disclosure.

3.5. Additional analysis

To further enhance our understanding of the association between business strategy and risk disclosure, we study the impact of the recent financial crisis and of different firm-level characteristics, namely, the firm's size, age, and degree of technological specialization.

3.5.1. Impact of the recent financial crisis

Table 3.8 reports the results for our risk disclosure model, including dummy variables *DuringFC,* for the financial years during the recent financial crisis, from 2007 to 2008, and *AfterFC,* for the financial years after the recent financial crisis, from 2009 to 2017, and their respective interaction terms with our business strategy proxies.

Table 3.8: Risk disclosure and business strategy: Impact of the financial crisis

	(1)	(2)	(3)
Dependent variable	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*
VARIABLES	Full sample	Full sample	Defenders and prospectors only
BusinessStrategy	0.00609		
	(1.545)		
Defender		-0.104**	
		(-2.437)	
Prospector		-0.0754	0.0168
		(-1.191)	(0.216)
DuringFC	0.166**	0.255***	0.241***
	(2.128)	(8.705)	(3.161)
AfterFC	0.656***	0.672***	0.744***
	(8.313)	(21.64)	(9.680)
BusinessStrategy × *DuringFC*	0.00559		
	(1.362)		
BusinessStrategy × *AfterFC*	0.00171		
	(0.409)		
Defender × *DuringFC*		0.00409	
		(0.0836)	
Defender × *AfterFC*		0.0511	
		(1.072)	
Prospector × *DuringFC*		0.0597	0.0599

		(0.898)	(0.739)
Prospector × AfterFC		0.155**	0.115
		(2.314)	(1.391)
FirmSize	0.200***	0.200***	0.189***
	(37.23)	(37.30)	(17.92)
Leverage	-0.0116	-0.0149	0.00745
	(-0.732)	(-0.938)	(0.202)
Profitability	-0.00146***	-0.00160***	-0.000655
	(-2.625)	(-2.849)	(-0.593)
Loss	0.0552***	0.0542***	0.0983**
	(3.238)	(3.173)	(2.350)
HistoricBeta	0.0871***	0.0891***	0.119***
	(5.557)	(5.715)	(3.502)
HistoricVolatility	-0.0134	-0.00506	-0.0850
	(-0.246)	(-0.0937)	(-0.796)
TradingVolume	0.0224***	0.0233***	0.0130
	(3.938)	(4.089)	(1.373)
CrossListing	0.0718***	0.0782***	0.129**
	(2.751)	(3.010)	(2.372)
Constant	2.339***	2.453***	2.560***
	(18.41)	(22.48)	(12.98)
Observations	12,065	12,065	1,946
Adjusted R^2	0.620	0.619	0.613
Year dummies	YES	YES	YES
Industry dummies	YES	YES	YES
Country dummies	YES	YES	YES

This table reports the results from OLS regressions of business strategy on risk disclosure, focusing on the effect of the recent financial crisis. We include the two dummy variables *DuringFC* and *AfterFC* to account for the financial years during the financial crisis (in 2007 and 2008) and the financial years after the financial crisis (from 2009 to 2017), respectively and their respective interactions with our independent variables of interest. In specification (1), the independent variable is the business strategy measure of Bentley et al. (2013). In specification (2), we include the two dummy variables *Prospector* and *Defender*. In specification (3), we limit the sample to prospector and defender firm–year observations. See Appendix A for variable definitions. Continuous variables are winsorized at the first and 99th percentiles. The *t*-statistics are reported in parentheses. Standard errors are heteroscedasticity robust and clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Column (1) of Table 3.8 includes *DuringFC* and *AfterFC* and their interactions with *BusinessStrategy*. The coefficients on the two interaction terms *BusinessStrategy* × *DuringFC* and *BusinessStrategy* × *AfterFC* are not significant, suggesting that the influence of a firm's business strategy on its risk disclosure behaviour was not altered during or after the recent financial crisis. In column (2), we include the two dummy variables *Defender* and *Prospector* and their interactions with *DuringFC* and *AfterFC*. The interaction term *Prospector* × *AfterFC* is positive and significant at the 5% level (coeff. = 0.155, *t*-stat. = 2.314), indicating that prospectors revealed even more risk information in the financial years after the recent financial crisis. However, in column (3), where

we limit our sample to defender and prospector firm–year observations, we are not able to observe the same effect. The interaction term of *Prospectors* × *AfterFC* does not show a significant coefficient. Thus, the effect of the recent financial crisis on the relation between prospector and risk disclosure seems weak.

3.5.2. Impact of firm size, age, and technological specialization

Table 3.9 reports the results for our subsample analysis. We re-estimate our main model for small versus large, young versus mature, and low- versus high-technology firms.

Table 3.9: Risk disclosure and business strategy: Firm characteristics

Panel A: Small versus large firms						
	(1)	(2)	(3)	(4)	(5)	(6)
	Firm size below the median			Firm size above the median		
Dependent variable	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*
VARIABLES	Full sample	Full sample	Defenders and prospectors only	Full sample	Full sample	Defenders and prospectors only
BusinessStrategy	0.0123***			0.00706**		
	(4.066)			(2.466)		
Defender		-0.0546*			-0.0989***	
		(-1.705)			(-3.438)	
Prospector		0.0735**	0.153**		0.0293	0.0829*
		(2.022)	(2.568)		(0.730)	(1.673)
Constant	1.845***	2.049***	2.143***	2.727***	2.857***	3.098***
	(10.39)	(12.12)	(6.318)	(14.20)	(15.51)	(8.807)
Observations	6,028	6,028	1,161	6,028	6,028	783
Adjusted R^2	0.496	0.493	0.488	0.459	0.460	0.498
Control variables	YES	YES	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES
Panel B: Young versus mature firms						
	(1)	(2)	(3)	(4)	(5)	(6)
	Firm age below the median			Firm age above the median		
Dependent variable	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*
VARIABLES	Full sample	Full sample	Defenders and prospectors only	Full sample	Full sample	Defenders and prospectors only
BusinessStrategy	0.0112***			0.00871***		
	(3.718)			(2.873)		
Defender		-0.0795**			-0.0739***	
		(-2.224)			(-2.597)	
Prospector		0.0662*	0.178***		0.0584	0.100*

		(1.961)	(2.923)		(1.407)	(1.768)
Constant	2.248***	2.448***	2.418***	2.185***	2.318***	2.369***
	(15.20)	(18.56)	(8.568)	(12.25)	(13.12)	(7.363)
Observations	6,026	6,026	987	6,026	6,026	957
Adjusted R^2	0.611	0.609	0.588	0.619	0.619	0.642
Control variables	YES	YES	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES

Panel C: Low- versus high-technology firms

	(1)	(2)	(3)	(4)	(5)	(6)
	Low-tech firms			High-tech firms		
Dependent variable	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*	*RiskDisclosure*
VARIABLES	Full sample	Full sample	Defenders and prospectors only	Full sample	Full sample	Defenders and prospectors only
BusinessStrategy	0.0154*			0.00459		
	(1.868)			(1.036)		
Defender		-0.0699			-0.0321	
		(-0.993)			(-0.403)	
Prospector		0.142	0.131		0.0138	0.227**
		(1.088)	(0.990)		(0.357)	(2.142)
Constant	2.249***	2.506***	2.247***	2.499***	2.580***	2.181***
	(6.167)	(7.317)	(3.648)	(15.19)	(18.69)	(5.550)
Observations	862	862	127	3,050	3,050	473
Adjusted R^2	0.577	0.575	0.702	0.644	0.643	0.642
Control variables	YES	YES	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES

This table reports the results from our subsample analysis. Panel A reports the results for small versus large firms, Panel B young versus mature firms, and Panel C low- versus high-technology firms. In specifications (1) and (4), the independent variable is the business strategy measure of Bentley et al. (2013). In specifications (2) and (5), we include the two dummy variables *Prospector* and *Defender*. In specifications (3) and (6), we limit the sample to prospector and defender firm–year observations. See Appendix A for variable definitions. Continuous variables are winsorized at the first and 99th percentiles. The *t*-statistics are reported in parentheses. Standard errors are heteroscedasticity robust and clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

In Panel A of Table 3.9, we rerun our main regressions for small (large) firms, that is, firms with a size below (above) the median value of *FirmSize*. The coefficient of *BusinessStrategy* is positive and significant for both small and large firms. However, the magnitude of the effect of *BusinessStrategy* on risk disclosure seems to be smaller for large firms. Comparing specifications (2) and (3) to (5) and (6), our findings suggest that the likelihood of prospectors reporting more than defenders about their risk factors is high for small firms. We argue that this is because large firms have other incentives to report on their risk factors. Large firms operate under the scrutiny of the public eye, under increased interest from internal and external stakeholders (Amran et al., 2009; Khlif and Hussainey, 2016). Large firms face pressure to adequately report their risk factors, and, thus, business strategy is a less important determinant of risk disclosure for these firms.

In Panel B of Table 3.9, we rerun our main regressions for young and mature firms separately. Specifications (1) to (3) show the results for firm ages below the median and specifications (4) to (6) for firm ages above the median. Consistent with Maffett (2012), we measure firm age in months, divided by 1,000. The age of a firm is determined by taking the difference between the fiscal year-end and the base date, which is the date when Datastream started following the firm. Our results show that the effect of business strategy on risk disclosure seems to be stronger for young firms than for mature firms.

Further, in Panel C of Table 3.9, we re-estimate our model for firms operating in technologically intensive industries and firms operating in low-technology industries.[18] We expect prospectors to be even more likely to reveal (voluntary) risk information if they operate in a high-technology industry, characterized by a rapidly changing environment. According to organizational theory, prospectors typically have greater incentive to reveal information (Bentley-Goode et al., 2019), because of their reliance on external financing, higher agency costs, and greater emphasis on marketing strategies (Bentley et al., 2013; Bentley-Goode et al., 2019). We expect this to be particularly true for firms operating in high-technology industries. Surprisingly, the results are mixed. The coefficient on *BusinessStrategy* is positive and significant (coeff. = 0.0154, *t*-stat. = 1.868) for low-technology firms (specification (1)). However, when analysing high-technology firms and restricting the sample further to defender and prospectors (specification

[18] We use Francis and Schipper's (1999) definition of high- and low-technology industries based on three-digit SIC codes.

(6)), we find that prospectors are more likely to report than defenders. This result does not seem to hold for low-technology firms (specification (3)).

3.6. Conclusion

Risk disclosure has been criticized for its lack of clear language (Financial Reporting Council, 2009), lack of specificity, and bias towards positive information (Association of Chartered Certified Accountants, 2014). To improve risk disclosure, the first step is to better understand what drives firms to report their risk factors. This study contributes to this discussion by analysing whether a firm's business strategy influences its risk disclosure behaviour.

The findings of our study suggest that business strategy, as defined by Miles and Snow (1978, 2003), is a determinant of risk disclosure. When analysing innovation-oriented prospectors and cost-efficient defenders in more detail, we find that prospectors are more likely to report their risk factors in the annual report. We argue that this is because, first, they adopt a business strategy that is inherently riskier and confronts them with high uncertainties and, second, because prospectors are more likely to reveal information voluntarily.

Further, our results show that the recent financial crisis does not seem to affect the relation between business strategy and risk disclosure. However, it seems that prospectors are more likely to reveal risk information in the years following the financial crisis, but the effect is weak. In addition, we find that the influence of business strategy on the amount of risk information in the annual report is stronger for small, young, or low-technology firms.

This study complements previous findings on the influence of business strategy on the information environment (Bentley-Goode et al., 2019) and on attributes of the annual report (Lim et al., 2018). These studies, however, focus on U.S. firms. Thus, to complete the picture, it would be interesting to investigate whether our results hold for U.S. firms and, in general, for firms outside the EEA. Further, our findings complement the findings of Bentley-Goode et al. (2019), who show that prospectors have more analysts following than the other types of firms, and Derouiche et al. (2020), who find that firms that report more about their risk factors in the annual report also have more analysts following them. Thus, future research should analyse the dynamics and causality between business strategy, risk disclosure, and analysts following.

3.7. References

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3.8. Appendix A: Variable definitions

Variable name	Definition	Source
Dependent variable		
RiskDisclosure	Number of sentences in the annual report containing at least one risk keyword from the list of Elshandidy et al. (2013). Our regression analysis includes the natural logarithm of this variable.	Computer-aided textual analysis based on annual reports
Independent variables		
BusinessStrategy	Composite measure based on six individual measures, computed using the average over a rolling 5-year window. The variables are ranked into quintiles, and values range between 1 and 5. All quintile ranks are added up. The individual measures are as follows:	
	(1) Ratio of research and development expenses to sales	Worldscope items WC01201 and WC01001
	(2) Ratio of the number of employees to sales	Worldscope items WC07011 and WC01001
	(3) One-year percentage change in sales	Worldscope item WC01001
	(4) Ratio of selling, general, and administrative expenses to sales	Worldscope items WC01101 and WC01001
	(5) Standard deviation of the number of employees	Worldscope item WC07011
	(6) Ratio of net property, plant, and equipment to total assets	Worldscope items WC02501 and WC02999
Prospector	Dummy variable taking the value of 1 if a firm's *BusinessStrategy* scores between 24 and 30, and 0 otherwise.	Based on *BusinessStrategy*
Defender	Dummy variable taking the value of 1 if a firm's *BusinessStrategy* scores between 6 and 12, and 0 otherwise.	Based on *BusinessStrategy*

Control variables		
FirmSize	Natural logarithm of the total assets of the firm.	Worldscope item WC02999
Leverage	Sum of short-term debt and long-term current debt, divided by firm common equity.	Worldscope items WC03051 and WC03501
Profitability	Return on assets of a firm.	Worldscope item WC08326
Loss	Dummy variable taking the value 1 if net income is below zero, and 0 otherwise.	Worldscope item WC01551
HistoricBeta	Average beta coefficient from the regression of the firm's stock return of the market return over the last 5 years.	Datastream expression 897E
HistoricVolatility	Average volatility of stock returns over the last 5 years.	Datastream expression 400E
TradingVolume	Daily trading volume divided by the number of common shares.	Datastream items VO and NOSH
CrossListed	Dummy variable taking the value 1 if the firm has American Depositary Receipts traded on a U.S. exchange, and 0 otherwise.	Worldscope item WC11496

3.9. Appendix B: Risk disclosure and business strategy, by country

Country	No. of firms	No. of firm–year observations	*RiskDisclosure*	*RiskDisclosure* (raw)	*BusinessStrategy*
Austria	36	179	5.468	264.078	18.101
Belgium	70	384	5.343	239.385	16.411
Bulgaria	4	7	5.441	281.143	12.429
Croatia	4	17	5.401	244.353	18.059
Cyprus	7	10	4.560	143.000	12.400
Czech Republic	4	14	5.427	253.071	14.000
Denmark	56	356	5.209	207.149	17.093
Estonia	6	35	5.278	209.629	14.800
Finland	84	476	5.490	266.118	17.456
France	197	1125	5.614	348.548	17.404
Germany	209	801	5.729	364.532	17.953
Greece	56	249	5.037	177.691	15.365
Hungary	10	45	5.550	314.400	15.222
Iceland	4	20	5.158	189.100	20.250
Ireland	34	182	5.250	215.929	17.148
Italy	133	704	5.647	323.114	16.903
Latvia	11	33	4.164	88.6970	14.758
Lithuania	4	7	5.151	229.286	15.429
Luxembourg	7	48	5.592	288.521	17.333
Malta	8	26	5.252	199.654	16.462
Netherlands	81	407	5.725	342.644	17.531
Norway	25	52	5.713	364.192	17.231
Poland	87	361	5.356	254.618	16.169
Portugal	24	122	5.691	338.992	14.467
Romania	5	10	5.547	308.000	13.200
Slovakia	3	18	5.461	297.222	13.333
Slovenia	6	28	6.084	459.464	16.250
Spain	29	124	5.717	374.935	15.177
Sweden	163	981	5.392	242.946	17.854
United Kingdom	977	5,244	5.081	201.198	17.093
Total	2,344	12,065			

This table reports descriptive statistics for our dependent variable, *RiskDisclosure* (natural logarithmic transformation and raw count values), and our independent variable of interest, *BusinessStrategy*, separately for all countries in our study. See Appendix A for variable definitions.

Chapter 4. The effect of risk disclosure on analyst following

4.1. Introduction

Financial analysts rely on different sorts of information communicated by the firm, notably the annual report, to make their earnings forecasts and recommendations regarding the firms they follow (Hope, 2003a).[19] There is a vast literature showing that the corporate information environment and, in particular, corporate disclosure have an impact on analyst following. Lehavy et al. (2011) and Sundgren et al. (2018) show that greater numbers of analysts follow firms with high-quality disclosures. Dhaliwal et al. (2012) and Gao et al. (2016) document increased analyst following after the initiation of corporate social responsibility reporting. Other studies provide evidence that the number of analysts following a firm is positively associated with overall voluntary disclosure (Hamrouni et al., 2017), corporate governance disclosure (Yu, 2010), and voluntary political spending disclosure (Goh et al., 2018), and the extent of note disclosure (Hope, 2003c).[20]

Although the vast majority of these studies establish that financial analysts typically prefer more transparent firms, it is unclear whether they do so with respect to risk disclosure that is generally associated with negative information. To fill this gap, the present study examines the effect of risk disclosure on the number of analysts following a firm. We focus on sell-side analysts,

[19] In the present research, we adopt the dominant view in the accounting literature that analysts are information users rather than information providers (Dhaliwal *et al.*, 2012; Hope, 2003a; Lang and Lundholm, 1996; Lehavy *et al.*, 2011). This means that analysts' activities complement corporate disclosure and do not replace it.

[20] Many studies address alternative aspects of the corporate information environment. For example, Lang *et al.* (2004) and Boubaker and Labégore (2008) show that analysts are less likely to follow firms with potential incentives to withhold or manipulate information, such as those with weak corporate governance and those dominated by controlling entities with substantial power and discretion. Bae *et al.* (2008) and Tan *et al.* (2011) report that analyst coverage increases with the extent to which the adoption of International Financial Reporting Standards (IFRS) eliminates differences between the accounting standards used in the firm's country and those used in the analyst's country.

that is, those who are employed by brokerage houses, research institutes, or investment banking firms and issue research reports including earnings forecasts and buy, hold, or sell stock recommendations.

Our focus on risk disclosure is of particular interest because the incentives for managers to voluntarily report about negative events/operations remain subject to many debates and research. Moreover, most risk information, such as the identification of firm-specific risks or on risk assessment, is difficult to obtain from sources other than the firm's annual report. In a survey exploring the views of users and preparers of risk information, Abraham et al. (2012) document that risk disclosure provided by corporate managers is the most important source of information for analysts. In direct interviews with analysts, two-thirds of the interviewees answering whether risk factor statements are useful or not responded that they find the information on risk factors provided by firms to be useful and revealing new information.

In the present research, we argue that firms with greater risk disclosure attract more analysts because the supply and demand for analyst services increases with the level of such disclosure. Based on arguments derived from institutional theory, firms might want to build reputation notably by disclosing negative information likely to be more credible and trustworthy than other types of information. Signalling theory holds that expanded corporate voluntary disclosure, such as risk disclosure, can serve as a signal of reduced information asymmetry between managers and market participants. The likely implication of this is that analysts would incur lower costs of information gathering with high-risk disclosure firms, implying greater analyst following.

Additionally, demand for analyst services is expected to be more important for high-risk disclosure firms. Indeed, a firm's potentially high exposure to risks would increase investors' concern about the firm's capacity to generate sufficient future cash flows (Kravet and Muslu, 2013), particularly since risky and uncertain environments are typically associated with increased agency problems between insiders and outsiders (Bhushan and Cho, 1996). Analysts' activities would thus be more valuable when risk disclosure is greater, resulting in a larger analyst following.

The measurement of risk disclosure is based on a content analysis approach. Following several studies, including Abraham and Shrives (2014), Campbell et al. (2014), Dobler et al., (2011) and Neri et al., (2018), we focus on the risk factor section of the annual report and analyse the effect

of negative and uncertain connotations of risk disclosure that is, indicating uncertain or negative future outcomes for the firm. Unlike the 10-K filings of U.S. firms, which are highly structured, French annual reports are unstructured, which requires the manual extraction of risk factor sections, leading to the uniqueness of our dataset. We use different proxies for risk disclosure, namely, the number of risk words appearing from Kravet and Muslu's (2013) keyword list, the number of sentences containing at least one risk word, the number of risk factors, and the number of total sentences in the risk factor section. These measures of risk disclosure quantity capture the effort that firms employ in identifying and describing the risks they are exposed to and can be valid proxies for the informativeness of such disclosures (Beretta and Bozzolan, 2004; Campbell et al., 2014).

In France, listed firms are required to report their significant risks in their annual report in accordance with International Financial Reporting Standards (IFRS). Contrary to the U.S. risk reporting environment, where firms must file their annual report to the U.S. Securities and Exchange Commission (SEC) in a standardized (10-K) form, including a description of their risk factors (Item 1A), risk information provided by firms reporting under IFRS is not provided in a standardized form. According to the International Accounting Standards Board (IASB), a firm is required, under IFRS, to disclose its 'principal risk exposures and changes in those risks, together with its plans and strategies for bearing or mitigating those risks, as well as disclosure of the effectiveness of its risk management strategies' (IASB, 2010, p. 13). The IASB puts special emphasis on requiring firms to report their principal risks rather than listing all the possible risks they could face. Contrary to the SEC, the IASB does not provide a template for the risk factor section or for the annual report. In addition, it does not require firms to report their annual report in a specific format. In France, and in accordance with IFRS as well as with French Commercial Law, the board of directors is required to include in the management report a description of significant risks and uncertainties that the firm faces, as well as objectives and policies regarding risk management.[21] It is also required that this management report be accompanied by the chairperson's report on internal control and risk management procedures.[22]

[21] See Articles L.225-100, L. 225-100-1, and paragraphs 2° and 4° of Article L. 225-100-2 of the French Commercial Code.
[22] See Articles L225-37 and L225-68 of the French Commercial Code.

Although no specific format for risk reporting is regulatorily defined, most firms provide in practice a specific section in their annual report devoted to the main risks and uncertainties they are facing, following the release by the Autorités des Marchés Financiers (AMF) —the regulator of France's financial markets—of the Recommendation of 29 October 2009 on risk factors that provides details on the minimum information to be reported in the 'Risk Factors' section of the annual report. [23] This section is intended to identify events and operations that could significantly affect the accounts of the firm in the short to medium term and that largely depend on the nature of the entity's businesses. In a nutshell, although French firms are required by law and regulation to report their significant risk factors, the absence of a standard legal and regulatory specific framework puts the content and the extent of risk reporting almost solely at management's discretion, thus turning it into a (quasi-) voluntary disclosure.

This paper uses detailed risk disclosure and analyst following data from France. The sample covers 113 non-financial and non-utility listed firms on the SBF 120 index over the period 2007–2015. France provides an interesting laboratory for several reasons. First, the study of the French setting allows conclusion to be drawn on the determinants of analyst coverage in the cradle of the French civil law system. Prior evidence, such as Chang et al. (2001), shows that, compared to common law countries, analyst coverage is lower in civil law countries, in which corporate financial reporting is likely to be less transparent (Ball et al., 2000). Second, as most of European countries, France is a bank-oriented economy, which, contrary to market-oriented economies, provides little protection to minority investors and poor law enforcement (La Porta et al., 1997). However, strong investor protection is one of the key goals of the SEC, explaining the strict regulations on risk reporting in the U.S. (Sarbanes-Oxley Act, 2002) compared to weakly regulated risk reporting of France. Third, French listed firms are characterized by a highly concentrated ownership structure and are often controlled by families (Boubaker and Labégorre, 2008). These specificities may lead to increased investors' demand for analyst services. All these characteristics make France an interesting setting to investigate how risk disclosure shapes the behaviour of analysts and allow for conclusions beyond the U.S. and other European settings.

[23] This recommendation is part of the Position-Recommendation Doc-2009-16 relative to the Guide to preparing registration documents of French listed firms.

Consistent with the prediction of an increased analyst following for firms with greater risk disclosure, we document a significant positive association between the four measurements of risk disclosure and the number of analysts who cover the firm, after controlling for other determinants of analyst following. We interpret this result as being consistent with the view that analysts are attracted by firms for which the costs of information gathering are low and the demand for analyst services is high, such as high-risk disclosure firms. Overall, our results are in line with prior literature highlighting that analysts' activities complement annual reports disclosures and, generally, corporate disclosure.

The present study contributes to both the risk disclosure and analyst literatures. First, prior risk disclosure literature has primarily been from a shareholder perspective, focusing on the association between risk disclosure and investor behaviour as reflected in stock returns (Kravet and Muslu, 2013), stock informativeness (Tan et al., 2017), stock liquidity (Neri et al., 2018), and initial returns of initial public offerings (Wasiuzzaman et al., 2018). Very few papers have adopted a different view, such as examining the effect of risk disclosure on audit fees (Yang et al., 2018) or the impact of customers' risk disclosure on suppliers' investment efficiency (Chiu et al., 2018). We complement this strand of literature by investigating for the first time how risk disclosure affects the decision of analysts to follow a firm. Thus, we are among the first to explore the behaviour of annual report users other than investors, namely, analysts.

Second, few prior studies have conducted a content analysis of the risk factors section outside the U.S. setting, that is, in environments in which the annual report is not structured and thus difficult to explore, such as in the U.K. (Abraham and Shrives, 2014; Linsley and Shrives, 2006), Canada (Dobler et al., 2011), Germany (Elshandidy et al., 2015), Italy (Beretta and Bozzolan, 2004; Elshandidy and Neri, 2015), Finland (Miihkinen, 2012), and China (Neri et al., 2018). By manually extracting the risk factor sections of the annual reports of French firms, we complement these prior studies with an approach combining manual and computer-aided content analysis in a European setting, that is, France. We obtain a unique dataset and, to the best of our knowledge, we are the first to systematically explore the risk factor section in French annual reports.

Third, we add to the literature on analysts as users of annual reports. Prior empirical work documents that specific components of the annual report are particularly useful for analysts, such

as accounting policy disclosures (Hope, 2003b), corporate social responsibility reporting (Dhaliwal et al., 2012; Gao et al., 2016), components of voluntary disclosure that do not cover risk disclosure (Hamrouni et al., 2017), voluntary political spending disclosures (Goh et al., 2018), and note disclosure (Hope, 2003c). Unlike these studies, we focus on risk disclosure information regarding its effect on analyst following, which, as far as we know, has not yet been explored.[24]

The remainder of the paper is organized as follows. Section 4.2 presents the theoretical background and develops the research hypothesis. Section 4.3 describes the data and variables. Section 4.4 reports the results of the main multivariate analysis as well as robustness checks. Section 4.5 addresses endogeneity issues. Section 4.6 concludes the paper.

4.2. Theoretical background and hypothesis development

This section presents the theoretical background of the present study (Section 4.2.1) and develops the research hypothesis (Section 4.2.2).

4.2.1. Theoretical background of risk disclosure

Although a number of theories have been proposed for the analysis of risk disclosure (Elshandidy et al., 2018), two could be particularly relevant in explaining the extent to which risk disclosure is useful for analysts, namely, institutional theory and signalling theory.

Institutional theory suggests that firms apply rules and incorporate norms to gain social acceptance (Oliver, 1991). Through extensive risk disclosure, firms are more inclined to comply with the value of the environment in which they evolve by providing it with a wide range of information on the uncertainties and risks to which they are exposed. Such uncertainty and risk disclosure information would be particularly useful for different stakeholders, including analysts, especially since this sort of negative information is difficult to obtain from sources other than annual reports. Institutional theory drives three forces that are likely to affect risk disclosure as a

[24] It is worth noting that, in particular, and similar to the work of Lehavy et al. (2011), our study is related to the literature examining the role of annual report quality in the decision of analysts to follow the firm, but the two studies differ in significant aspects. Importantly, Lehavy et al. analyse the complexity of the language employed in the entire annual report, namely, the report's readability, whereas our study focuses on a specific part of this report, that is, the risk factor section, by examining the quantity of information related to risks. Thus, the two studies look at different dimensions of the information provided in the annual report, since we examine how much risk-related information is publicly reported by firms as part of voluntary disclosure, whereas Lehavy et al. study the extent to which annual reports are written in an accessible and readable style.

form of voluntary disclosure: regulative, mimetic, and normative pressure (Scott, 1995; Elshandidy et al., 2015). Regulative pressure is inherent in the requirements, even when they comprise generic and vague terms, of the laws and regulations to report significant risk factors in annual reports. Firms can also mimic the risk disclosure behaviour of their peers to signal their alignment with industry standards (Abraham and Shrives, 2014). Normative pressure can also induce managers to reveal risk information voluntarily in response to the recommendations of different local and international regulatory bodies (Elshandidy et al., 2015).

Signalling theory, as suggested by Spence (1973), holds that a voluntary disclosure environment sends a positive signal of reduced information asymmetry between a firm and market participants (e.g. Diamond and Verrecchia, 1991; Healy and Palepu, 2001). In particular, high-risk disclosure can signal managers' unobservable efforts to identify and manage most of the risks faced by the firm via the observable amount of risk reporting in annual reports. Empirical work highlights the roles of mandatory risk disclosure (Miihkinen, 2012; Elshandidy and Neri, 2015) and of risk factor disclosure (Campbell et al., 2014) in reducing information asymmetry. The signalling environment could, however, be affected by the way signals are interpreted by those who use them (Rynes et al., 1991). Thus, expanded risk disclosure can be viewed either positively, as an indicator of less information asymmetry and a firm's higher awareness and ability to manage the risks it is exposed to, or negatively, as a signal of higher exposure to risks and thus greater uncertainty in its future cash flows.

4.2.2. Hypothesis development

Analysts are considered among the major users of information provided in annual reports (Schipper, 1991). The quantity of annual report disclosures is, for example, shown by Hope (2003a) to significantly affect the accuracy of analysts' earnings forecasts. Indeed, as financial professionals, analysts play an important intermediary role, given their ability to analyse and interpret corporate disclosure when forecasting earnings (Boissin and Sentis, 2014; Sundgren et al., 2018).

An analyst's decision to follow a firm is based on the costs and benefits of doing so. The lower the costs of following a firm, the more attractive is the firm to the analyst. These costs are essentially associated with the acquisition of information about new firms (Bae et al., 2008). There

is sound evidence that a firm providing more extensive risk disclosures suggests lower costs for analysts, giving them incentives to follow the firms. First, based on the above developments in the institutional theory framework, firms could acquire a good reputation by reporting their risks. Since reputation is valued in its own right, analysts could value the risk disclosure information of highly reputed firms.

Second, from the perspective of signalling theory, expanded risk disclosure can signal managers' willingness to mitigate information asymmetry with market participants by providing them with both qualitative and quantitative risk information (Hope 2003a; Sundgren et al., 2018). As users of corporate disclosure, analysts can benefit from reduced information asymmetry by incurring lower costs of information gathering while making more accurate forecasts. In this regard, Lang et al. (2004) find that analysts are more reticent to follow firms that have incentives to withhold information. Bushman et al. (2005) show a lower analyst following in environments of high information asymmetry driven by weak insider trading laws.

Third, the risk reporting in annual reports is carried out by management on the basis of, essentially, inside information and a multifaceted analysis of the firm environment as conducted by specialized corporate committees such as audit, risk, risk management, and corporate governance committees. This means that most of the risk disclosure information in annual reports has already been compiled and processed, which would translate into less time and effort put forth by analysts to engage in further information acquisition and processing procedures.

Fourth, analysts are perceived to play a monitoring role by regularly following the firm's accounts and providing research reports to investors (Jensen and Meckling, 1976; Chen et al., 2015; Zhang, 2018). As a form of voluntary disclosure, risk disclosure can increase the observability of managerial actions, thus allowing for closer monitoring of managerial actions by shareholders and other stakeholders. For example, Farag et al., (2014) show that firms with greater number of risk factors have better governance. This implies lower monitoring costs for analysts in firms that already give different market participants the opportunity to monitor management through expanded voluntary disclosure. This is even more relevant when considering risk disclosure, given that bad news conveyed by such disclosure is inherently more credible and

trustworthy than other types of information, thus contributing further to the reduction of agency costs (Linsley and Shrives, 2006; Miihkinen, 2012).

From another angle, risk disclosure typically reflects a firm's exposure to risk and increases investors' risk perception, suggesting that unknown contingencies and risks are communicated to the investors (Kravet and Muslu, 2013; Linciano et al., 2018; Bohnert et al., 2019). This would raise investors' concerns about the firm's capacity to generate sufficient future cash flows and thus ensure long-term sustainability (Abraham and Shrives, 2014). In this respect, Neri et al., (2018) find that bad news is priced negatively by the market and, therefore, investors' risk perception is increased and market liquidity is worsened by creating information asymmetry. Since analysts are perceived as a sort of seal of approval in risky and uncertain environments, the demand for analyst services is expected to be higher for firms with greater risk disclosure. For example, Barth et al. (2001) show that the number of analysts following a firm is higher if the firm has more intangible assets, because such assets are usually associated with inherent uncertainty, making analyst services more valuable.

Moreover, firms that are subject to numerous risks can involve greater agency problems with investors, requiring more analyst scrutiny to resolve these problems (Moyer et al., 1989; Bhushan and Cho, 1996). Further, bad news that is voluntarily disclosed in annual reports, such as that contained in risk reporting, usually conveys vague and less formal information (Skinner, 1994). Indeed, managers are more reticent, intentionally or unintentionally, to provide precise and detailed information about highly risky projects because of the uncertainties of future cash flows inherent in these sorts of projects, as well as the risk that these managers would be penalized for not achieving their targeted results.[25] In such an environment, analysts are expected to add more value in intermediating risk disclosure information to investors, using their expertise and professional experience, arguably increasing the demand for analyst services and, thereby, the analyst following (Bhushan, 1989; Zhang, 2018).

Based on all these arguments, we hypothesize that firms with greater risk disclosure are followed by greater numbers of analysts.

[25] For example, Tsai et al. (2016) show that greater volumes of risk factor disclosure are associated with higher credit risk.

4.3. Data and variables

This section presents the sample selection procedure (Section 4.3.1), describes the variables (Section 4.3.2), and reports descriptive statistics and correlation analysis (Section 4.3.3).

4.3.1. Sample and data sources

Our sample consists of French firms on the SBF 120 index over the period 2007−2015. Following prior studies, we exclude financial firms and utilities firms because of their specific regulations. We also discard observations that are missing data. We are left with a sample of 857 observations of 113 firms.

The number of analysts following a firm is obtained from the historical Institutional Broker Estimation System (I/B/E/S) international database. The risk factor sections are extracted manually from the firms' annual reports, which are downloaded from the firms' respective websites. The numbers of risk words, risk-related sentences, and total sentences are obtained by computer-aided content analysis and the numbers of risk factors are computed manually. All control variables are obtained from Thomson Reuters Datastream.

4.3.2. Regression variables

In this section, we provide details on the measurement of the variables used in the main analysis. The Appendix presents the definitions and data sources for all the variables used for the empirical tests.

4.3.2.1. Analyst following

Our dependent variable, *Analyst*, is the number of analysts following a firm. It is measured as the number of earnings per share estimates issued by analysts per year for a particular firm.

4.3.2.2. Risk disclosure

Following the relevant risk disclosure literature, our risk disclosure measures are based on a textual analysis of the risk factor section of firms' annual reports (e.g., Linsley and Shrives, 2006; Dobler et al., 2011; Campbell et al., 2014). In this analysis, we do not consider any risk management policy description or any risk coverage/insurance coverage sections. The goal is to include only the pure description of the risks, since we are interested in the potential impact of

information on events/operations with uncertain or negative future outcomes for the firm, consistent with previous studies (e.g. Linsley and Shrives, 2006).

It is worth noting that our sample consists of the largest French listed firms in which it is common to communicate and to report both in French and in English, given that their target audience is public and international and they usually cross-list in the U.S. or/and in other international markets. Zreik and Louhichi (2017) highlight a high level of congruence between the French and the English versions of the annual reports of French listed firms belonging to the SBF 120 index. Thus, we validate the use of the English version of annual reports for this study, and we are ensured that this will not lead to potential bias in our conclusions.

The first step of our analysis consists in downloading annuals reports from the firms' websites. Next, we manually extract textual risk disclosures that generally appear to be a risk factor section of the annual report. Lastly, we analyse, both manually and with computer assistance, the files obtained and construct four variables for risk disclosure. Higher values of these variables are associated with greater firm transparency and more informative risk disclosure.

First, the variable *Risk_words* is the number of risk words, measured as the natural logarithm of the number of risk words in the risk factor section. Consistent with our focus on risk disclosures with negative or uncertain connotations, we opt for the following risk word list, provided by Kravet and Muslu (2013): *can/cannot, could, may, might, risk*, uncertain*, likely to, subject to, potential*, vary*/varies, depend*, expos*, fluctuat*, possibl*, susceptible, affect, influenc*,* and *hedg**. The asterisk implies that suffixes are allowed. This choice is, in addition, consistent with our reading of 20 randomly selected risk factor sections extracted from the annual reports of the sampled firms.[26]

Second, the variable *Risk_sentences* is the number of sentences containing at least one risk word from the above-mentioned list, measured as the natural logarithm of the number of risk-related sentences in the risk factor section. A certain consensus in the risk disclosure literature has

[26] Other risk word lists are either i) very limited, such as that of Li (2006), who uses only the words *risk* and *uncertain* (and their derivatives); ii) very expanded, such as that of Loughran and McDonald (2011), who propose a comprehensive dictionary of negative, positive, uncertain, and litigious word categories, in addition to strong and weak modal words; or iii) a mix of positive words (i.e. related to opportunities and outlooks) and negative words, such as that of Elshandidy and Neri (2015).

emerged regarding the advantages of using sentences as coding units instead of words (Linsley and Shrives, 2006; Abraham and Cox, 2007; Dobler et al., 2011; Kravet and Muslu, 2013; Abraham and Shrives, 2014). Indeed, in a text, one sentence is generally intended to convey one idea, which can avoid counting an item of risk information more than once if a sentence contains numerous risk words (Kravet and Muslu, 2013). In our counting process, a table or headline is treated as one sentence.

Third, the variable *Risk_factors* is the number of risk factors, measured as the natural logarithm of the number of risk factors in the risk description section. Risk factors provided by managers in the annual report are shown to meaningfully convey to investors a firm's exposure to risks (Beretta and Bozzolan, 2004; Abraham and Shrives, 2014; Campbell et al., 2014). We consider all types of risk factors, including those specific to the firm or to the industry in which the firm operates, as well as financial and general non-financial risk factors. Our analysis of risk factors is not limited to simply counting risk factors as highlighted in the headlines of the risk factor section; we examine each subsection in depth to identify all the risks that are reported by the firm.

Fourth, the variable *Total_sentences* is the number of total sentences, measured as the natural logarithm of the number of total sentences in the risk factor section. This variable is the most direct measure of the length of risk disclosure could also gauge the quality of such disclosure. Indeed, the mainstream literature on voluntary disclosure suggests that the quantity of the information can be used as a sound proxy for its quality (Beretta and Bozzolan, 2004; Campbell et al., 2014).

2.1.1. Control variables

In our main analysis, we control for a set of variables that are shown in the literature to influence analyst following. The variable *Ownership*, measured as the voting rights of the largest shareholders, is introduced to control for the possibility that a firm's analyst following is influenced by the power of dominant shareholders, following Hope (2003c), Lang *et al.* (2004) and Boubaker and Labégorre (2008). Consistent with these studies, greater control by dominant shareholders is expected to be negatively associated with the analyst following. Firm size (*Size*), measured as the natural logarithm of total sales, is used as a control because analysts are more willing to follow larger firms (e.g. Bhushan, 1989; O'Brien and Bhushan, 1990; Lang and Lundholm, 1996). The variable *Beta* is included to control for the systematic risk of a firm's stock

returns. It is measured by regressing the daily returns of the respective firm on daily market returns, based on the SBF 120 index, over the previous year. We also control for the variable *Earnings surprise*, since prior literature shows a significant influence of earnings quality on analysts' decision to follow a firm (Lang and Lundholm, 1996). It is measured as the absolute value of the difference between current and one-year lagged earnings per share, scaled by the stock price at the beginning of the fiscal year. We include the variable *Return STD*, measured as the annualized volatility of daily stock returns over the last three years, to account for the volatility of a firm's stock price. Indeed, the high costs inherent in the greater uncertainty of firms with higher stock return volatility can deter analysts from following them (Lehavy et al., 2011), whereas issuing recommendations about those firms would be more valuable to investors, thus attracting more analysts (Bhushan, 1989; Jiang and Kim, 2016). The variable *Profitability*, measured as the return on invested capital, is introduced in the model because analysts shy away from unprofitable firms. We include the market-to-book ratio, *Market-to-Book*, to control for analysts' potentially greater interest in high-growth firms (Barth et al., 2001; Lehavy et al., 2011). A dummy variable, *XLIST*, is included when the firm cross-lists in the United States (Boubaker and Labégorre, 2008). We also include the dummy variable *Issuance* to indicate if a firm issued capital during the financial year, since such a firm is expected to be followed by more analysts. We further introduce the control variable *Intangible*, measured as the percentage of intangible assets to total assets, because intangible assets are typically associated with high uncertainty, making analyst services more valuable to investors (Barth et al., 2001; Lehavy et al., 2011).

4.3.3. Descriptive statistics and correlation

Table 4.1 reports summary statistics for the dependent variable, the four risk disclosure measures, and all the control variables employed in the main regression analysis. The dependent variable has a mean of 16.31 and a median of 16; on average, firms are followed by 16 analysts. The table shows the raw text variables used to compute the risk disclosure measures. On average, the extracted texts and, thus, the description of the firm's exposure to risks and uncertainties cover 252.34 sentences. In these extracted portions of the annual report, firms employ, on average, 145.57 risk keywords. We find, on average, 136.53 sentences that contain at least one risk keyword, which means that around 54% of all sentences are related to risk. What is striking is that there seem to be large differences between firms and across years. The minimum number of

sentences of the extracted texts is 17 and the maximum is 878. Similar large ranges can be observed for the number of risk words and the number of risk-related sentences.

The size of the sample firms is varying between 0.0612 million euros (first percentile) and 90.440 million euros (99th percentile) with a relatively high average of 12.2608, which is consistent with the nature of our sample (i.e. firms in the SBF120 index). The mean beta, a proxy for systematic risk, is 0.82 in our sample. The average percentage of voting rights of the largest shareholder is 34%. The mean earnings surprise is 0.0030, indicating that the average firm does not exhibit high earnings volatility. The average annualized standard deviation of daily stock returns over three years ranges from 0.1770 to 0.7090, suggesting a certain degree of heterogeneity in the volatility of stocks across firms and time. During the sample period, the mean value of returns on invested capital, a proxy for firm profitability, is 0.078, which means that, on average, the firms in our sample are profitable. The book value exceeds the market value of the average firm in our sample; the mean market-to-book value is 0.8520. More than half of the firms in our sample are cross-listed in the United States and more than 75% issued capital over the sample period. The percentage of intangible assets to total assets ranges from 0.36% to 63.75%, with an average of 28.4%.

Table 4.1: Descriptive statistics

Variable	Mean	STD	1st percentile	25th percentile	Median	75th percentile	99th percentile
Analyst	16.3090	7.8080	1.0000	10.0000	16.0000	21.0000	37.0000
Risk_sentences	136.526	77.479	10.000	80.000	123.000	174.000	441.000
Risk_words	145.565	80.054	9.000	89.000	132.000	180.000	473.000
Risk_factors	34.317	22.556	0.000	17.000	31.000	45.000	110.000
Total_sentences	252.337	142.761	17.000	157.000	227.000	315.000	878.000
Ownership	0.3434	0.2478	0.0000	0.1158	0.2995	0.5446	0.9587
Size (millions of euros)	12.2608	20.4711	0.06120	1.4000	3.9000	14.0000	90.440
Beta	0.8200	0.3280	0.0880	0.5770	0.8174	1.0470	1.5800
Earnings surprise	0.0030	0.1370	-0.6100	-0.0160	0.0023	0.0150	0.7460
Return STD	0.3310	0.1040	0.1770	0.2490	0.3113	0.3950	0.7090
Profitability	0.0780	0.0900	-0.3140	0.0420	0.0726	0.1120	0.4970
Market-to-book	0.8520	0.8840	0.0690	0.3440	0.6108	1.0260	6.2730
XLIST	0.5250	0.5000	0.0000	0.0000	1.0000	1.0000	1.0000
Issuance	0.8670	0.3400	0.0000	1.0000	1.0000	1.0000	1.0000
Intangible	0.2840	0.1660	0.0036	0.1620	0.2765	0.3980	0.6375

This table reports summary statistics of the variables used in the main analysis. See the Appendix for the variable definitions. Raw values are given for the risk disclosure variables. The total sample consists of 857 firm–year observations of non-financial and non-utility French firms on the SBF 120 index over the period 2007–2015.

Table 4.2 describes mean risk disclosure by industry and by year. Panel A describes risk disclosure across industries. The results show that, for the four risk disclosure variables, firms from the textile and trade industries as well as the leisure industry have the lowest values. In the transportation and utilities industries, firms seem to report more extensively about their risk exposure. Firms in the petroleum industry exhibit the highest average number of risk factors. This is consistent with the notion that firms from industries with severe environmental impacts have more pressure to engage in extensive voluntary disclosure (Mallin and Ow-Yong, 2012), including that of risks. Panel B presents the average level of risk disclosure over the sample. The results show an increase in the amount of risk information disclosed in the French annual reports, which is consistent with the upward trend in risk disclosure worldwide (Campbell and Slack, 2008).

Table 4.2: Risk disclosure by industry and by year

		N	*Risk_sentences*	*Risk_words*	*Risk_factors*	*Total_sentences*
Panel A: Risk disclosure measures by industry						
Industry	Two-digit SIC codes					
Petroleum	13, 29	32	155.7500	170.8438	54.8438	332.4063
Consumer durables	25, 30, 36, 37, 50, 55, 57	178	140.5899	153.6517	35.0618	248.0393
Basic industry	10, 12, 14, 24, 26, 28, 33	72	163.9583	163.9444	45.7778	289.6667
Food and tobacco	1, 2, 9, 20, 21, 54	48	128.4792	141.5000	34.7500	230.0208
Construction	15, 16, 17, 32, 52	44	152.2500	171.2955	33.9318	315.4091
Capital goods	34, 35, 38	62	118.7258	128.9677	25.3387	219.5000
Transportation	40, 41, 42, 44, 45, 47	36	194.6389	196.7500	32.4167	336.7222
Utilities	46, 48	100	178.6400	181.6800	43.0500	334.4000
Textiles and trade	22, 23, 31, 51, 53, 56, 59	62	95.0484	106.0645	17.0806	179.7097
Services	72, 73, 75, 76, 80, 82, 87, 89	178	109.2472	117.6742	31.7697	210.7697
Leisure	27, 58, 70, 78, 79	45	105.6000	111.7778	26.6667	174.6667
Panel B: Risk disclosure measures by year						
Year						
2007		86	94.942	97.291	24.942	174.221
2008		88	107.398	113.034	28.034	197.000
2009		90	123.567	130.411	30.844	234.433
2010		95	128.832	137.874	32.747	245.516
2011		92	137.065	145.891	34.359	252.967

2012	95	146.695	158.884	36.389	273.842
2013	103	154.573	165.175	38.350	285.922
2014	105	160.190	170.762	39.771	291.943
2015	103	162.524	176.126	40.456	292.417

This table describes the mean risk disclosure by industry (Panel A) and by year (Panel B). See the Appendix for the variable definitions. Raw values are given for the risk disclosure variables. *N* is the number of observations. The total sample consists of 857 firm–year observations of non-financial and non-utility French firms on the SBF 120 index over the period 2007–2015. The term SIC stands for Standard Industrial Classification.

Table 4.3 reports the Pearson correlations. The four proxies for risk disclosure are positively and significantly correlated with the number of analysts following firms. This is a first indicator that risk disclosure is an important factor in analysts' decision to follow a firm. In addition, the analyst following is significantly correlated with most of our control variables.

Table 4.3: Correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) *Analyst*	1														
(2) *Risk_sentences*	0.252***	1													
(3) *Risk_words*	0.267***	0.986***	1												
(4) *Risk factors*	0.214***	0.618***	0.602***	1											
(5) *Total_sentences*	0.220***	0.963***	0.943***	0.611***	1										
(6) *Ownership*	-0.237***	0.0258	0.00102	0.0444	0.00706	1									
(7) *Size*	0.662***	0.0700*	0.105**	0.0470	0.0314	-0.164***	1								
(8) *Beta*	0.297***	0.225***	0.228***	0.264***	0.130***	-0.289***	0.367***	1							
(9) *Earnings surprise*	0.00477	0.00496	0.00956	-0.00542	0.0230	0.0209	-0.00686	0.00204	1						
(10) *Return STD*	-0.161***	0.114***	0.0990**	0.152***	0.0400	-0.118***	-0.112**	0.477***	0.0252	1					
(11) *Profitability*	0.131***	-0.131***	-0.134***	-0.148***	-0.0444	0.0107	-0.0640	-0.169***	0.155***	-0.236***	1				
(12) *Market-to-book*	0.0150	-0.121***	-0.121***	-0.142***	-0.0527	0.0955**	-0.329***	-0.255***	0.00206	-0.185***	0.358***	1			
(13) *XLIST*	0.477***	0.269***	0.288***	0.253***	0.116***	-0.250***	0.488***	0.251***	0.00310	-0.0467	-0.0939**	-0.0913**	1		
(14) *Issuance*	-0.0257	0.00211	0.00995	-0.0448	0.0732*	-0.120***	0.0587	0.0440	-0.00428	0.109**	-0.111**	-0.171***	0.0133	1	
(15) *Intangible*	0.161***	-0.0428	-0.0435	-0.0846*	0.00773	-0.0542	0.0523	-0.0919**	0.0235	-0.203***	0.0308	-0.0592	-0.0189	-0.0162	1

This table reports the Pearson correlation coefficients for all the variables in our main regressions. All the variables, except for *Analyst*, are lagged by one year. See the Appendix for variable definitions. The total sample consists of 857 firm–year observations of non-financial and non-utility French firms on the SBF 120 index over the period 2007–2015. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

4.4. Empirical evidence

This section presents the results of regressions of the effect of risk disclosure on analyst following (Section 4.4.1) and of the role of corporate opacity in such effect (Section 4.4.2) as well as the results of robustness checks (Section 4.4.3).

4.4.1. Main evidence: Effect of risk disclosure on analyst following

To test the effect of risk disclosure on the number of analysts following a firm, we estimate the following model specification:

$$Analyst_{i,t+1} = \beta_0 + \beta_1 RiskDisclosure\ measure_{i,t} + \beta_2 Ownership_{i,t} + \beta_3 Size_{i,t} + \beta_4 Beta_{i,t} + \beta_5 Earnings\ surprise_{i,t} + \beta_6 Return\ STD_{i,t} + \beta_7 Profitability_{i,t} + \beta_8 Market\text{-}to\text{-}Book_{i,t} + \beta_9 XLIST_{i,t} + \beta_{10} Issuance_{i,t} + \beta_{11} Intangible_{i,t} + \beta_{12} Year\ Dummies + \beta_{13} Industry\ Dummies + \varepsilon_{i,t} \quad (1)$$

where all the variables are described in the Appendix. All the control variables are lagged by one period and winsorized at the 1% level in both tails. The model includes industry and year fixed effects to control for inter-industry and time variations in analyst following. We employ an ordinary least squares (OLS) regression with standard errors that are Huber–White heteroskedastic robust and clustered by firm.

Table 4.4 reports the results of the effects of different proxies for risk disclosure on analyst following. In specification (1) in Table 4.4, we note that risk disclosure as proxied by the variable *Risk-sentences* is positively associated with the number of analysts that follow the firm the subsequent year. This association is also highly statistically significant at the 1% confidence level and suggests that firms with higher levels of risk disclosure are more likely to be followed by a greater number of analysts. In specification (2), we use the variable *Risk_words* as the measurement of firm risk disclosure and find that the results are similar to those for specification (1). Specifications (3) and (4) reveal the same picture, showing that the coefficient on *Total_sentences* and *Risk_factors* loads positively and statistically significantly at the 1% confidence level.[27]

[27] The results are robust to the winsorization of risk disclosure variables at the first and 99th percentiles.

Table 4.4: Main analysis: Risk disclosure and analyst following

Variable	(1)	(2)	(3)	(4)
Risk_sentences	2.5631***			
	(0.5852)			
Risk_words		2.3594***		
		(0.5804)		
Risk_factors			1.6402***	
			(0.3979)	
Total_sentences				2.6161***
				(0.6501)
Ownership	-4.0620**	-3.7841**	-4.1682***	-3.7668**
	(1.6005)	(1.6282)	(1.5708)	(1.5243)
Size	7.2667***	7.1656***	7.3513***	6.9674***
	(0.8594)	(0.8725)	(0.8597)	(0.9730)
Beta	4.4478***	4.5742***	4.2139***	4.9286***
	(1.3302)	(1.3577)	(1.3409)	(1.6126)
Earnings surprise	0.0499	-0.0472	0.1134	0.0065
	(0.9276)	(0.9165)	(0.9254)	(0.9045)
Return STD	-14.3354***	-14.1256***	-14.2730***	-13.9226***
	(4.3357)	(4.3539)	(4.3240)	(4.4599)
Profitability	8.6439**	8.8239**	8.8821**	8.4160**
	(3.4511)	(3.4969)	(3.4875)	(3.3683)
Market-to-book	2.3471***	2.3301***	2.4144***	2.2201***
	(0.4548)	(0.4511)	(0.4758)	(0.4494)
XLIST	1.6024**	1.6567**	1.6100**	2.0499**
	(0.7507)	(0.7610)	(0.7624)	(0.8137)
Issuance	-0.0371	-0.0751	0.2075	-0.2843
	(1.2462)	(1.2404)	(1.2865)	(1.1752)
Intangible	7.1768***	7.2967***	7.7405***	7.7034***
	(2.1310)	(2.1936)	(2.1329)	(2.4903)
Intercept	-0.3202	-0.7047	-2.7036	5.1969*
	(3.6637)	(3.8066)	(4.2589)	(2.8794)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Adjusted R^2	0.681	0.677	0.679	0.676

This table reports the results from OLS regressions of risk disclosure on analyst following. The dependent variable, *Analyst*, is the number of analysts following the firm. All independent variables are lagged by one year. See the Appendix for variable definitions. The total sample consists of 857 firm–year observations of non-financial and non-utility French firms on the SBF 120 index over the period 2007–2015. Year and industry dummies following Campbell's (1996) classification are included in all the regressions. The coefficient standard errors are in parentheses beneath coefficient estimates. Standard errors are Huber–White heteroskedastic robust and clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

To assess the economic significance of our results, we examine the impact of a change in each of the four proxies of risk disclosure on firms' analyst following the subsequent year while holding other variables constant. A one standard deviation increase in *Risk_sentences* implies an increase of 1.6 in the number of analysts following the firm. This value translates into a relative increase of 9.81% over the average analyst following (considering the mean value of *Analyst* of 16.3; see

Table 1).[28] Similarly, a one standard deviation increase in *Risk_words*, *Total_sentences*, and *Risk_factors* implies an increase of, respectively, 9.22%, 9.72%, and 8.65% in the average analyst following.

Our findings support our hypothesis predicting a positive association between risk disclosure and the number of analysts following the firm, which means that firms with greater risk disclosure attract more analysts. This result can be attributed to lower costs of information gathering for analysts covering firms that already report extensively on their risks in their annual reports, especially since this type of information is difficult to obtain from other sources. Our findings are also consistent with greater investor demand for analyst services in those firms subject to greater uncertainties because of their exposure to multiple risks. We thus find support for the evidence of prior studies (e.g., Lang and Lundholm, 1996; Hope, 2003a; Lehavy et al., 2011; Dhaliwal et al., 2012) suggesting that analysts are among the most important users of annual reports, in particular, risk disclosure which is very difficult information to obtain from other sources.

From an institutional perspective, a number of arguments supporting the positive effect of risk disclosure on analyst following particularly hold for French firms. Interestingly, given that legal and regulatory risk disclosure requirements in France are low, firms could differentiate themselves and gain in reputation by providing higher risk disclosure, which typically attracts more analysts. Moreover, in civil law countries and bank-oriented economies, such as in France, investors face greater challenges inherent in high corporate opacity and low levels of investor protection (La Porta et al., 1997), which renders analyst services more valuable, particularly in firms exposed to higher risks. Hence, analysts would benefit more from following these firms, which would explain why the increased risk disclosure of French firms results in higher analyst following. In relation to this view, the monitoring role of analysts seems to be particularly valuable to minority investors in the French legal environment, which is characterized by a highly concentrated corporate ownership and the dominance of controlling shareholders having substantial control over the firm (Boubaker and Labégorre, 2008).

[28] This value is calculated by considering a coefficient for *Risk_sentences* of 2.5631 and a standard deviation of 0.624 for the natural logarithm of the number of risk-related sentences.

The coefficients of the control variables are, overall, consistent with the literature. As expected, we find that analysts prefer covering large firms because of the potentially greater transparency of larger groups. Analysts are also found to be attracted to firms showing higher risk and to those with a greater proportion of intangibles, since investor demand for analyst services is expectedly higher for riskier firms. Analyst are, however, more reticent to follow firms with high return volatility and those whose shareholders wield substantial control power, since higher costs would be incurred in doing so. The results also document greater analyst preferences for healthier firms, that is, more profitable firms and firms with more growth opportunities. Further, analysts tend to be more interested in firms that cross-list their shares in the United States compared to those that do not. We find, however, that analyst following is not significantly affected by earnings forecast error or by whether a firm issued capital during the financial year.

4.4.2. Additional analysis: Effect of corporate opacity

In our main analysis, analyst following is shown to be higher in firms with greater risk disclosure, probably because of lower costs of information gathering in these firms. To reinforce this view, we conduct additional analysis examining whether the positive effect of risk disclosure on analyst following is more pronounced for more opaque firms. Indeed, the value of analyst services typically increases in firms where investors face greater challenges inherent in increased uncertainty and information asymmetry. Consequently, analyst output is expected to be more valuable for more opaque firms (Loh and Stulz, 2018). Thus, analysts can add more value to investors of these firms while profiting from a competitive advantage of covering them (Boubaker and Labégorre, 2008). Accordingly, the complementary information role of analysts is expected to be more relevant for more opaque firms, implying a greater effect of risk disclosure on analyst coverage in these firms. To test this conjecture, we split our sample into Low opacity or High opacity groups, depending on whether the bid–ask spread at the end of the fiscal year is below or above the median value of distribution. Indeed, a high (low) bid–ask spread results from low (high) liquidity, which translates into high (low) information asymmetry and thus into high (low) corporate opacity. The results of estimating our baseline model across the two groups of firms are reported in Table 4.5. They show that the coefficient of *Risk_sentences* is higher in the High opacity group compared to that in the Low opacity group. This implies that the positive association between risk disclosure and analyst following is more pronounced in more opaque firms,

indicating that corporate opacity increases analysts' likelihood to follow firms with higher risk disclosure. This result suggests that analysts benefit more from collecting information among these firms, which provides additional evidence that analysts are more attracted by high-risk disclosure firms in which they will incur lower costs of information gathering.

Table 4.5: Additional analysis: Effect of corporate opacity

Variable	Low opacity (1)	High opacity (2)
Risk_sentences	2.8594***	4.6264***
	(0.5766)	(0.9470)
Ownership	-0.9926	-7.6277***
	(2.0033)	(2.3221)
Size	7.9388***	10.6120***
	(1.0830)	(1.5530)
Beta	3.1896*	3.5347**
	(1.7246)	(1.5897)
Earnings surprise	-1.8172	1.4440
	(1.6858)	(0.9517)
Return STD	-12.0578**	-8.0640
	(5.0091)	(4.8315)
Profitability	4.7273	5.0761
	(3.7413)	(5.4790)
Market-to-book	1.8036***	6.2178***
	(0.3260)	(1.0876)
XLIST	1.4207	1.7911**
	(0.9048)	(0.8217)
Issuance	0.0526	0.9499
	(1.1269)	(1.1508)
Intangible	3.3084	4.1402
	(3.1524)	(2.8563)
Intercept	-1.3786	-15.2725**
	(3.9994)	(5.8325)
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Sample size	431	425
Adjusted R^2	0.593	0.660

This table reports the results from OLS regressions of risk disclosure on analyst following across Low opacity and High opacity groups. Low (High) opacity group consists of firms having the bid–ask spread at the end of the fiscal year below (above) the median value of distribution. The dependent variable, *Analyst*, is the number of analysts following the firm. All independent variables are lagged by one year. See the Appendix for variable definitions. The total sample consists of 857 firm–year observations of non-financial and non-utility French firms on the SBF 120 index over the period 2007–2015. Year and industry dummies following Campbell's (1996) classification are included in all the regressions. The coefficient standard errors are in parentheses beneath coefficient estimates. Standard errors are Huber–White heteroskedastic robust and clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

4.4.3. Robustness checks

In this section, we conduct robustness checks using alternative measures for risk disclosure (Section 4.4.3.1) and alternative statistical techniques (Section 4.4.3.2).

4.4.3.1. Alternative risk disclosure variables

Table 4.6 reports the results of robustness tests using aggregate and refined measures of risk disclosure. First, we compute a risk disclosure index from the four variables used in our main analysis – that is, *Risk_sentences*, *Risk_words*, *Total_sentences*, and *Risk_factors* – using principal component factor analysis.[29] This analysis generates one common significant factor with an eigenvalue of 3.267 (i.e., greater than one), that explains 81.69% of the total variance. We include this new measure of risk disclosure, *Risk_index*, in specification (1) and find again that the corresponding coefficient is positive and statistically significant at the 1% confidence level. This supports our main finding that firms with greater risk disclosure attract more analysts.

Second, we construct four refinements of *Risk_factors* variable by creating four categories of risk factors identified in the risk factor section, namely, general risks (specification (2)), firm-specific risks (specification (3)), industry-specific risks (specification (4)), and financial risks (specification (5)). Firm-specific risks are risk factors that are specific to the firm operations and processes, such as reliance on one client or supplier, risk related to the obsolescence of machines and equipment, or liability risk. However, industry-specific risks are risk factors to which all/ the majority of companies belonging to a same industry are exposed, such as those related to the economic or geopolitical environment.[30] Financial risks are risks related to the firm's exposure to financial and capital markets (e.g., credit risk, currency risk, liquidity risk). General risks are all risk factors that cannot be classified in the previous three categories. The results from specifications (2) to (5) show a positive and highly statistically significant coefficient for the risk disclosure variables, indicating that analysts are attracted by the different types of risks that the

[29] A similar methodology was used by Miihkinen (2012) and Yang et al. (2018).

[30] An example of a firm-specific risk factor in ACCOR's 2015 annual report is as follows:

> *In general, the Group is exposed to the risk of liability in proceedings that may be brought against it before the courts or administrative authorities* (p.132).

An example of an industry-specific risk factor in ACCOR's 2015 annual report is as follows:

> *Like all hotel operators, AccorHotels is required to comply with the applicable disabled access regulations. This issue has long been addressed and most of the Group's hotels already have wheelchair-friendly rooms, but further expenditure may be required in the coming years to further enhance hotel accessibility* (p.132).

firm faces, particularly when it comes to financial risks, as shown by the largest magnitude for the coefficient of financial risks.

Third, we construct the variable *Risk_factor coverage*, considering the four risk factor categories above and using the Herfindahl index to take into account the weight of each risk factor categorys (specification (6)). The measure of this variable is as follows:

$$Risk\_factor\ coverage = [(1/H)/4] \quad (2)$$

where H is the Herfindahl index of concentration across risk factor categories, calculated as $H = \sum_{i=1}^{n} P_i^2$, and P is the number of risk factors by category divided by the total number of risk factors. The main results remain materially unchanged.

Fourth, we measure risk disclosure using the ratio of the number of risk-related sentences in the risk factor section to the number of total sentences in the risk factor section (specification (7)). We find that our conclusions are not affected by this alternative analysis.

Table 4.6: Robustness checks: Alternative measures of risk disclosure

	Risk_index (1)	*General risks* (2)	*Firm-specific risks* (3)	*Industry-specific risks* (4)	*Financial risks* (5)	*Risk_factor coverage* (6)	*Risk_sentences_ ratio (7)*
Risk disclosure measure	1.5014***	1.1912***	0.9407***	1.3145***	2.2532***	6.5054***	9.5697**
	(0.3694)	(0.3882)	(0.3218)	(0.2557)	(0.7270)	(1.4398)	(4.3414)
Ownership	-3.7841**	-3.7999**	-3.3792**	-3.0519**	-3.0384*	-2.8150*	-4.0447**
	(1.6282)	(1.6556)	(1.4968)	(1.5019)	(1.5849)	(1.4627)	(1.6663)
Size	7.1656***	6.9610***	7.0124***	6.9102***	6.9476***	6.6384***	6.3649***
	(0.8725)	(0.9582)	(0.9805)	(0.9384)	(0.9082)	(0.9054)	(0.9177)
Beta	4.5742***	5.2707***	5.0529***	5.2287***	5.0142***	4.9426***	5.4568***
	(1.3577)	(1.5969)	(1.5936)	(1.4517)	(1.4271)	(1.3903)	(1.3942)
Earnings surprise	-0.0472	0.1286	0.1267	0.1876	-0.0038	0.0288	-0.2810
	(0.9165)	(0.9247)	(0.9179)	(0.8911)	(0.9435)	(0.8848)	(1.0118)
Return STD	-14.1256***	-14.8963***	-13.5497***	-13.4554***	-13.4762***	-13.6542***	-11.1614**
	(4.3539)	(4.6608)	(4.7335)	(4.5199)	(4.7300)	(4.4382)	(5.0080)
Profitability	8.8239**	7.6465**	8.7458**	8.2132**	8.7791**	8.2838**	7.6917**
	(3.4969)	(3.5173)	(3.5635)	(3.2090)	(3.4268)	(3.2026)	(3.6737)
Market-to-book	2.3301***	2.2291***	2.2386***	2.1980***	2.2782***	2.0682***	2.2281***
	(0.4511)	(0.4402)	(0.4439)	(0.4352)	(0.4556)	(0.4799)	(0.4706)
XLIST	1.6567**	2.1737***	2.1743***	2.0186**	2.2390***	2.0690***	2.4073***
	(0.7610)	(0.8061)	(0.8245)	(0.7711)	(0.7975)	(0.7511)	(0.9037)
Issuance	-0.0751	-0.4824	-0.1928	-0.1864	-0.0651	-0.4910	-0.7274
	(1.2404)	(1.1468)	(1.2601)	(1.1738)	(1.2353)	(1.1795)	(1.2069)
Intangible	7.2967***	7.8283***	7.9261***	8.0178***	8.0967***	7.2833***	7.0166***
	(2.1936)	(2.5474)	(2.5285)	(2.3762)	(2.3469)	(2.4168)	(2.4080)
Intercept	11.5978***	9.1257***	8.2132***	7.3128**	5.2711*	6.3008**	5.7120
	(2.7028)	(2.9140)	(2.8140)	(2.8770)	(3.1514)	(3.1314)	(3.5637)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.677	0.669	0.664	0.677	0.664	0.674	0.619

This table reports the results of robustness checks of the effect of risk disclosure on analyst following using alternative measures for risk disclosure. The dependent variable, *Analyst*, is the number of analysts following the firm. All independent variables are lagged by one year. See the Appendix for variable definitions. The total sample consists of 857 firm–year observations of non-financial and non-utility French firms on the SBF 120 index over the period 2007–2015. Year and industry dummies following Campbell's (1996) classification are included in all the regressions. Coefficient standard errors are in parentheses beneath coefficient estimates. Standard errors are Huber–White heteroskedastic robust and clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

4.4.3.2. Alternative statistical techniques

Table 4.7 presents the results of robustness checks to alternative statistical approaches. First, we perform a dynamic generalized method of moments (GMM) estimation that contains one-year lagged dependent variable and a set of lagged endogenous variables as instruments (specification (1)). The results show that the risk disclosure effect on analyst following is strongly positive at the 1% statistical level, thus reinforcing the prediction of the research hypothesis. Our GMM model is well specified and uses valid instruments, as shown by the *p*-values of the second-order serial correlation and of the Hansen test of overidentification, 0.841 and 0.644, respectively. Second, we estimate our model using the Fama–MacBeth procedure that estimates yearly cross-sectional regressions (specification (2)). The coefficient of *Risk_sentences* continues to be positive and highly statistically significant. Third, we perform a weighted least squares (WLS) regression to account for the unequal distribution of sample firms across industries (specification (3)). We obtain materially similar results to those previously reported. Fourth, we use a random effects model that allows for between-firm variability and accounts for heterogeneity across studies and find qualitatively similar results (specification (4)). Fifth, given that our dependent variable, *Analyst*, is a nonnegative integer, we use count data regressions instead of linear regressions. In particular, we employ a negative binomial model (specification (5)) and a Poisson model (specification (6)). The results from both models are consistent with those of the main analysis. Sixth, we construct a dummy variable for analyst following that equals one if the variable *Analyst* is above the median and zero otherwise and conduct a logit regression (specification (7)). The resulting coefficient on *Risk-sentences* is again positive and highly significant at the 1% level, consistent with our main finding that more analysts follow a firm with greater risk disclosure.[31]

[31] These results are robust to using the variable *Risk_sentences_ratio*.

Table 4.7: Robustness checks: Alternative statistical techniques

Variable	GMM (1)	Fama–MacBeth (2)	WLS (3)	Random effect (4)	Negative binomial (5)	Poisson (6)	Logit (7)
Risk_sentences	1.5069***	3.0474***	4.0445***	2.2949***	0.1882***	0.1714***	1.3869***
	(0.4296)	(0.2039)	(0.2767)	(0.3678)	(0.0196)	(0.0191)	(0.5002)
Ownership	-4.3748**	-3.8931***	-3.4583***	-3.4336***	-0.2243***	-0.1923***	-1.4039
	(2.2300)	(0.5282)	(0.6565)	(1.2032)	(0.0479)	(0.0501)	(0.9967)
Size	5.5759***	7.3312***	8.3636***	7.4824***	0.4712***	0.4616***	3.2932***
	(0.7387)	(0.3629)	(0.2928)	(0.5938)	(0.0253)	(0.0291)	(0.6256)
Beta	0.5152	4.6973***	5.4590***	1.4134**	0.3810***	0.3705***	2.6674***
	(0.5671)	(0.7843)	(0.5881)	(0.5596)	(0.0471)	(0.0585)	(0.5149)
Earnings surprise	0.2940	-1.1103	0.5351	0.4223	-0.0010	-0.0059	-0.3963
	(0.4745)	(1.7607)	(0.7744)	(0.7409)	(0.0784)	(0.0868)	(0.5028)
Return STD	-0.1374	-16.6367**	-13.8044***	-6.7982***	-1.2345***	-1.0047***	-7.9563***
	(2.2682)	(5.1667)	(2.1032)	(1.9812)	(0.1662)	(0.2163)	(1.7181)
Profitability	2.9658*	9.4488***	-3.5981**	2.2309	0.7589***	0.8009***	5.0354***
	(1.7562)	(1.4327)	(1.6471)	(1.7068)	(0.1385)	(0.1568)	(1.8598)
Market-to-book	1.8360***	2.2989***	5.0559***	1.4459***	0.1353***	0.1353***	1.0263***
	(0.2386)	(0.3068)	(0.3742)	(0.2648)	(0.0144)	(0.0164)	(0.3111)
XLIST	-0.6268	1.5637***	0.9853***	0.5550	0.0893***	0.1006***	0.7803*
	(0.7723)	(0.3248)	(0.3536)	(0.3941)	(0.0265)	(0.0262)	(0.4294)
Issuance	0.7654	-0.5961**	3.0893***	0.9298**	0.1471***	-0.0284	-0.0176
	(1.1138)	(0.1853)	(0.5659)	(0.4649)	(0.0470)	(0.0322)	(0.6378)
Intangible	14.2749***	5.7068***	1.9533***	1.5016***	0.2046***	0.4075***	1.3513
	(3.6074)	(1.0646)	(0.6202)	(0.5131)	(0.0501)	(0.0649)	(1.1612)
Lag_Analyst	0.3531***						
	(0.0726)						
Constant	-1.3633	0.3807	-8.6982***	4.0350	1.5150***	1.5267***	-8.4867***
	(2.9794)	(1.3768)	(1.4351)	(2.7108)	(0.1158)	(0.1272)	(2.6326)
Year dummies	Yes	No	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2 (pseudo R^2)	AR(1) = 0.000	{0.67}	0.8184	[0.6494]	(0.1513)	(0.3088)	(0.7124)
{avg-R^2} [overall R^2]	AR(2) = 0.841						
	Hansen = 0.644						

This table reports the results of robustness checks of the effect of risk disclosure on analyst following using alternative statistical approaches. In specifications (1) to (6), the dependent variable is *Analyst*, computed as the number of analysts following the firm. In specification (5), the dependent variable is a dummy measure of analyst following that equals one if the variable Analyst is above the median and zero otherwise. *Lag_Analyst* is one-year lagged value of *Analyst.* All independent variables are lagged by one year. See the Appendix for variable definitions. The total sample consists of 857 firm–year observations of non-financial and non-utility French firms on the SBF 120 index over the period

2007–2015. Year and industry dummies following Campbell's (1996) classification are included in all the regressions, except for specification (2), which does not include year dummies. Coefficient standard errors are in parentheses beneath coefficient estimates. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

4.5. Endogeneity

In this section, we address the endogeneity issue to take into consideration the potential reverse causality problem, that is, that high analyst following could, on average, lead to greater risk disclosure. Indeed, the scrutiny of greater numbers of analysts would put more pressure on managers to increase corporate disclosure, including risk disclosure. Moreover, the potential presence of omitted variables that is likely to affect both risk disclosure and analyst following could bias our results. We deal with these issues using propensity score marching technique (Section 4.5.1), instrumental variable approach (Section 4.5.2), and a quasi-natural experiment (Section 4.5.3).

4.5.1. Propensity score matching

Panel A of Table 4.8 presents the results of propensity score matching. As suggested by Dehejia and Wahba (2002), this technique allows for the identification of a control sample of firms with low risk disclosure (below the median value) but similar characteristics as firms with high risk disclosure (above the median value). For each firm with high risk disclosure, we select the closest firm with low risk disclosure in terms of its probability of high risk disclosure, that is, its propensity score. We match on industry and year because firm characteristics are likely a function of industry and time. Such an approach allows one to control for observable differences in characteristics between the groups with low and high risk disclosure.[32]

In a first step, a probit model is used to calculate the propensity scores of the treated and matched groups of firms. In this model, the dependent variable is a dummy measure of risk disclosure that takes the value of one if the variable *Risk_sentences* is above the median and zero otherwise; the independent variables are *Leverage*, *Size*, *Beta*, *Return STD*, and *Market-to-book*, as well as industry and year dummy variables (specification (1)). These independent variables are selected based on previous studies on the determinants of risk disclosure. The propensity score matching procedure results in a treatment sample of 428 firm–years equally distributed between the groups of firms with low and high risk disclosure. The probit regression results yield a positive and statistically significant coefficient for *Leverage*, *Size*, and *Beta*, indicating that firms can

[32] We conduct propensity score marching estimation within a maximum distance of 1% and with replacement, consistent with prior work, such as that of Morgan and Harding (2006).

disclose more about their risks when they are more leveraged, larger, and riskier. These results are consistent with the view that firms that are exposed to higher litigation and political costs tend to be more transparent.

In a second step, we estimate our baseline model over the treatment sample and find that the results are similar to our earlier findings (specification (2)). Notably, the coefficient of *Risk_sentences* loads positively and statistically significantly at the 10% confidence level, which is consistent with the view that greater risk disclosure is associated with a larger analyst following. Moreover, the estimated coefficients of the control variables exhibit similar signs and statistical significance as in the main analysis.

4.5.2. Instrumental variable approach

Panel B of Table 4.8 presents the results of two-stage instrumental variable estimation. In specification (1), we estimate the first-stage of the instrumental variable model. For a given firm, the instrument for *Risk_sentences* is measured as the average value of this variable in the sample of all other studied firms in the same industry group. This instrument captures the fact that firms with similar activities are more inclined to adopt a similar risk disclosure policy. We use the instrument along with the same exogenous variables as those used in the just-above probit model to explain risk disclosure. We find that the instrument enters with a positive coefficient which is statistically significant at the 1% statistical level. Moreover, all explanatory variables, except for market-to-book, exhibit statistically significant coefficients, suggesting their relevance to risk disclosure policy. We also report a partial F-statistic and R-squared of excluded instruments of, respectively, 53.5267 and 11.36%, meaning that we do not have a weak-instrument problem (Stock and Yogo, 2005). In specification (2), the second-stage estimation uses the fitted value of *Risk_sentences* from the first-stage regression as variable of interest. The coefficient on this fitted value is found to be positive and statistically significant at the 1% level, reinforcing our main finding that increased risk disclosure is associated with greater analyst following.

4.5.3. Quasi-natural experiment

To further alleviate potential endogeneity concerns, we examine a quasi-natural experiment, that is, an event that affected the extent of risk disclosure but not analyst coverage. Specifically, we examine the reaction of analyst coverage to the exogenous event of releasing the AMF

Recommendation of 29 October 2009 on risk factors. Despite the absence of empirical evidence on the positive effect of such a recommendation on risk reporting, one should expect that listed firms in France, in particular the largest ones, comply with the recommendations of the regulatory bodies, notably by increasing their risk disclosure. Therefore, the release of such a recommendation by the AMF would offer an interesting setting for capturing major changes in corporate risk disclosure practices and may represent real-side shocks that exogenously shift the scope of risk reporting. We evaluate how analyst coverage reacts to the event of releasing the regulatory recommendation on the risk factor section of the annual report in 2009 using a difference-in-difference approach. In particular, we replicate our baseline regressions using a dummy variable that takes the value one for the period after 2009, that is, from 2010 to 2015, and zero otherwise. This method allows us to compare the responses of a treatment group (i.e., observations over the period 2010–2015, that is, firms having a good risk disclosure policy) to those of a control group (i.e., observations over the period 2007–2009, that is, firms having a poor risk disclosure policy). The results of the difference-in-difference analysis examining the impact of AMF's recommendation release shock on analyst following are reported in Panel C of Table 4.8. They show that firms are followed by more analysts after the release of AMF's recommendation on the risk factor section of the annual report, compared to the period before the release. This effect is economically significant, given that the number of analysts following a firm after AMF's recommendation increases by more than four. Overall, this finding is consistent with our main hypothesis predicting that more risk disclosure gives an incentive to a greater number of analysts to follow the firm.

Table 4.8: Endogeneity

Panel A: Propensity score matching estimation			Panel B: Instrumental variable estimation			Panel C: The quasi-natural experiment	
Variable	Probit (1)	Propensity score matched sample (N=428) (2)	Variable	First-stage regression (1)	Second-stage regression (2)	Variable	Diff-in-diff estimation
Risk_sentences		1.4375*	*Risk_sentences (fitted)*		5.8789***	*Shock*	4.5641***
		(0.7910)			(0.8993)		(0.8252)
			Ind_ average_risk	1.0282***			
				(0.1006)			
Leverage	0.4356***		*Leverage*	0.1326***			
	(0.1098)			(0.0379)			
Ownership	0.3915*	-7.8018***	*Ownership*	0.3298***	-5.0378***	*Ownership*	-3.0801*
	(0.2312)	(1.1455)		(0.0783)	(0.8080)		(1.6153)
Size	-0.1365	7.7175***	*Size*	-0.0843**	7.8362***	*Size*	7.0291***
	(0.1148)	(0.5574)		(0.0399)	(0.3984)		(0.9526)
Beta	0.6990***	0.3815	*Beta*	0.4353***	2.3007***	*Beta*	5.4043***
	(0.1736)	(1.0233)		(0.0630)	(0.8016)		(1.4813)
Earnings surprise		-0.2014	*Earnings surprise*		-0.4191	*Earnings surprise*	0.0906
		(1.5303)			(1.2794)		(0.9217)
Return STD		-12.9427***	*Return STD*		-16.1666***	*Return STD*	-13.2689***
		(2.9993)			(2.5918)		(4.8891)
Profitability		7.6469***	*Profitability*		7.7946***	*Profitability*	9.0428**
		(2.5160)			(2.1456)		(3.6345)
Market-to-book	0.07147	2.5158***	*Market-to-book*	-0.0214	2.3762***	*Market-to-book*	2.2513***
	(0.0632)	(0.3334)		(0.0231)	(0.2333)		(0.4390)
XLIST	0.5917***	0.9488	*XLIST*	0.2564***	0.5900	*XLIST*	2.3713***
	(0.1270)	(0.6010)		(0.0451)	(0.5020)		(0.8212)
Issuance		-1.7477***	*Issuance*		-0.5714	*Issuance*	0.0200
		(0.6734)			(0.5123)		(1.2904)
Intangible	1.6200***	4.2511***	*Intangible*	0.4330***	5.6182***	*Intangible*	8.4095***
	(0.3421)	(1.6257)		(0.0810)	(1.0557)		(2.4316)
Intercept	-1.8470***	11.8992***	*Intercept*	-1.2098**	-10.9177***	*Intercept*	9.6682***
	(0.3524)	(4.5507)		(0.5033)	(3.5630)		(2.9128)
Year dummies	Yes	Yes	*Year dummies*	Yes	Yes	*Year dummies*	Yes
Industry dummies	Yes	Yes	*Industry dummies*	No	No	*Industry dummies*	Yes
			F-test (Partial R^2) of excluded instruments	53.5267*** (0.1136)			
Adjusted R^2 (pseudo R^2)	(0.2308)	0.6623	Adjusted R^2		0.6022	Adjusted R^2	0.651

This table addresses endogeneity issues. Panel A presents the results of propensity score matching. Specification (1) presents the results of the probit regression used to calculate propensity scores, where the dependent variable is a dummy that equals one if the variable *Risk_sentences* is above the median and zero otherwise. Specification (2) presents the results of the OLS regressions using a propensity score matched sample, where the dependent variable is *Analyst*, measured as the number of analysts following the firm. Panel B

provides the results of instrumental variable estimation. Specification (1) presents the results of the first-stage of the instrumental variable model (*Risk_sentences* as dependent variable) with *Ind_ average_risk* (measured as the average of *Risk_sentences* for the all other firms in the same industry group) as the instrument for risk disclosure. Specification (2) presents the results of the second-stage regression. Panel C provides the results of the difference-in-difference analysis that tests the effect of the release of the AMF Recommendation of 29 October 2009 on risk factors on analyst following. *Shock* is a dummy variable that takes the value one for the period 2010–2015, and zero otherwise. All independent variables are lagged by one year. See the Appendix for variable definitions. The total sample consists of 857 firm–year observations of non-financial and non-utility French firms on the SBF 120 index over the period 2007–2015. Year and industry dummies following Campbell's (1996) classification are included in all the regressions, except for specifications in Panel B, which do not include industry dummies. Coefficient standard errors are in parentheses beneath coefficient estimates. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

4.6. Conclusion

Research provides evidence of a correlation between corporate disclosure and analyst following (e.g. Lang and Lundholm, 1996; Hope, 2003a; Lehavy et al., 2011). Using a sample of non-financial and non-utilities firms on the 120 SBF index over the period 2007−2015, this study extends this line of research to shed light on the effect of risk disclosure in the firm annual report on the number of analysts following the firm. We focus on the risk factor section of the annual report because of our interest in uncertain and negative connotation disclosures. Unlike the 10-K filings of U.S. firms, which are highly structured, French annual reports are unstructured, which requires manual extraction of the risk factor sections, leading to the uniqueness of our dataset.

This study documents several interesting findings. The results from our main analysis show a positive and significant association between risk disclosure and analyst following, suggesting that firms providing greater risk disclosure attract more analysts. These findings are consistent with the notion that analysts can incur lower costs of information gathering in firms with greater risk disclosure, which gives them sufficient incentive to follow these firms. Moreover, investor demand for analyst services presumably increases with risk disclosure as a remedy for a firm's exposure to multiple risks, leading to greater analyst following.

The evidence presented in this research expands our understanding of the role of analysts as major users of annual reports and pins down the importance of analysts' activities in complementing information conveyed in firm annual reports and, generally, in corporate disclosures. This makes our findings interesting to researchers, analysts, managers, and regulators. A natural extension of this research that we propose for future study is an exploration of the extent to which risk disclosure affects the accuracy of analysts' forecasts.

4.7. References

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4.8. Appendix: Variable definitions and data sources

Variable	Definition	Data sources
Dependent variable		
Analyst	The number of analysts following the firm, based on the number of earnings per share estimates issued by analysts per year.	I/B/E/S
Risk disclosure variables		
Risk_words	The natural logarithm of the number of risk words in the risk factor section of the annual report. The risk words are from Kravet and Muslu's (2013) risk word list: *can/cannot, could, may, might, risk*, uncertain*, likely to, subject to, potential*, vary*/varies, depend*, expos*, fluctuat*, possibl*, susceptible, affect, influenc**, and *hedg**. The asterisk implies that suffixes are allowed.	Computer-aided content analysis based on annual reports
Risk_sentences	The natural logarithm of the number of sentences in the risk factor section of the annual report containing at least one risk word appearing in Kravet and Muslu's (2013) risk word list.	As above
Total_sentences	The natural logarithm of the number of total sentences in the risk factor section of the annual report.	As above
Ind_ average_risk	The average of *Risk_sentences* for the all other firms in the same industry group.	
Risk_factors	The natural logarithm of the number of risk factors reported in the risk factor section of the annual report.	Manual content analysis based on annual reports
General risks	The natural logarithm of the number of risk factors that are non-financial and not specific to the firm or the industry to which it belongs.	As above
Firm specific risks	The natural logarithm of the number of risk factors that are specific to firm operations and processes.	As above
Industry specific risks	The natural logarithm of the number of risk factors to which all or the majority of companies belonging to a same industry are exposed.	As above
Financial risks	The natural logarithm of the number of risk factors resulting from exposure to financial and capital markets.	As above
Risk disclosure index	The common factor extracted from the main risk disclosure variables (i.e. *Risk_sentences*, *Risk_words*, *Total_sentences*, and *Risk_factors*) using principal component analysis.	Authors' calculation

Risk_factor coverage	Risk factor coverage considering the four risk factor categories identified above and using the Herfindahl index *Risk_factor coverage = [(1/H)/4]*, where *H* is the Herfindahl index of concentration across risk factor categories, calculated $H = \sum_{i=1}^{n} P_i^2$, and *P* is the number of risk factors by category divided by the total number of risk factors.	As above
Risk_sentence_ratio	The ratio of the number of risk-related sentences in the risk factor section to the number of total sentences in the risk factor section.	As above
Control variables		
Ownership	Voting rights of the largest shareholder.	Datastream data
Size	Firm size, measured as the natural logarithm of total sales.	Authors' calculations based on Datastream data
Beta	The firm systematic beta, measured as daily returns of the respective firm on daily market returns, based on the SBF 120 index, over the previous year.	As above
Earnings surprise	The absolute value of the difference between current and one-year lagged earnings per share, scaled by the stock price at the beginning of the fiscal year.	As above
Return STD	The volatility of returns, measured as the annualized volatility of daily stock returns over the last three years, to account for the volatility of a firm's stock price.	As above
Profitability	The firm's profitability, measured as the return on invested capital.	As above
Market-to-Book	The firm's growth opportunities, measured as the market-to-book ratio.	As above
XLIST	A dummy variable that equals one when the firm cross-lists in the United States, using the American Depositary Receipt (ADR) program, and zero otherwise.	As above
Issuance	A dummy variable that equals one if a firm issued capital during the financial year and zero otherwise.	As above
Intangible	Intangible assets, measured as the percentage of intangible assets to total assets.	As above
Leverage	The ratio of total debt to total assets.	As above

Chapter 5. The relevance of risk disclosure and the role of readability and comparability

5.1. Introduction

Risk disclosure has gained momentum over the last two decades with regulators, standard setters, investors and other stakeholders acknowledging its importance (e.g. Financial Reporting Council (FRC), 2009; International Accounting Standards Board (IASB), 2010; Investor Responsibility Research Center Institute (IRRCi), 2016). Information about risk should help investors and other information users better evaluate firm risk exposure and expected outcomes (IASB, 2010). Information on firm-specific risk exposure or risk assessment and mitigation is especially difficult to obtain from sources other than the firm itself. Previous studies analyse how investor risk perception changes as a function of risk information published in annual reports (Bao & Datta, 2014; Campbell, Chen, Dhaliwal, Lu, & Steele, 2014; Elshandidy & Shrives, 2016; Hope, Hu, & Lu, 2016; Kravet & Muslu, 2013). Investor risk perception describes investor reaction to risk disclosure. Results are mixed. Risk disclosures either introduce unknown, and thus new, risk factors, resolve known risk factors or do not contain valuable information (Kravet & Muslu, 2013). Kravet and Muslu (2013) and Campbell et al. (2014) report increased investor risk perception following risk disclosure, suggesting that unknown risk factors are introduced. Bao and Datta (2014) and Elshandidy and Shrives (2016) find support for both increased and decreased investor risk perception when differentiating among risk factor topics and between positive and negative tone, suggesting that known risk factors are resolved. Bao and Datta (2014) find evidence that some risk factor topics are not relevant, and thus are boilerplate.

We extend the literature on the effect of risk disclosure on investor risk perception by focusing on U.K. companies. Our single-country setting allows us to draw conclusions for a homogeneous

sample of companies operating under and exposed to the same legal and extra-legal regulations and institutional characteristics (Boubaker & Labégorre, 2008; Brochet, Jagolinzer, & Riedl, 2013). As pointed out by Elshandidy, Shrives, Bamber, & Abrahams, (2018), there is limited evidence on the informativeness of risk disclosure outside the U.S. There are regulatory differences between the U.S. and the U.K., supporting the need to study how investors react to risk disclosure of U.K. firms. U.S. companies are facing stricter risk disclosure regulations than U.K. firms (Dobler et al., 2011). Managers of U.K. firms have much more freedom and discretion in reporting risk information. Further, with regulations being formulated more vaguely in the U.K., U.K. companies have been found to be reporting a greater variety of information on their exposure to risks (Abraham and Shrives, 2014; Collins et al., 1993). In addition to the regulatory differences between the two countries, there are cultural differences that might affect the disclosure behaviour of firms and the relevance of the published information. When comparing Hofstede's (2001) cultural values for these two countries, the U.S. is more likely to avoid uncertainties than the U.K., while the U.K. is more long term oriented than the U.S.[33]

Listed U.K. companies must prepare their financial statements in accordance with International Financial Reporting Standards (IFRS). The International Accounting Standards Board (IASB) requires financial information to be relevant, and it defines this as one of the fundamental qualitative characteristics of financial information. In its *Conceptual Framework for Financial Reporting*, the IASB qualifies financial information as relevant if it is able to make a difference in the decision-making of information users. Two enhancing characteristics of financial information in the *Conceptual Framework for Financial Reporting* are understandability and comparability across time and across firms. As defined in the *Conceptual Framework for Financial Reporting*, financial information should be presented clearly and concisely to ensure its understandability. Further, financial information should be comparable to similar information of other companies and comparable to similar information of the same firm for previous periods.

For a sample of U.K. listed companies from 2005 to 2017, we test whether risk disclosure meets the IASB's expectations in terms of relevance. Our findings show that risk disclosure measured by the natural logarithm of the number of risk-related sentences is relevant and increases

[33] Hofstede's (2001) cultural values for the U.K. and the U.S. can be found and compared online at https://www.hofstede-insights.com/product/compare-countries/.

investor risk perception. In annual reports, new and unknown risks are communicated (Kravet & Muslu, 2013). To enhance our understanding of the relevance of risk disclosure, we measure the systematic and idiosyncratic portion of risk disclosure in annual reports and systematic and idiosyncratic perceived risk. We define systematic risk disclosure as information on risk factors that are market-wide, i.e. risks that many companies in the market or in an industry are exposed to. We define idiosyncratic risk disclosure as information on risk factors specific to a particular company. Decomposing risk disclosure into firm-specific and market-wide risk information shows that systematic risk disclosure, measured by the natural logarithm of the number of systematic risk-related sentences, and idiosyncratic risk disclosure, measured by the natural logarithm of the number of idiosyncratic risk-related sentences, are relevant and increase investor perception of systematic and idiosyncratic firm risk, respectively.

To further enhance our understanding of the usefulness of risk disclosure, we examine whether the understandability and comparability of risk disclosure, two of the enhancing qualitative characteristics of financial information defined by the IASB, impact its relevance. In recent studies, the readability of disclosure is often used as a proxy for the understandability of financial information (Li, 2008; Richards & van Staden, 2015; Lewis & Young, 2019). Lehavy, Li, and Merkley (2011) find that less readable annual reports attract more analyst following while demanding greater analyst effort in generating their reports. Lo, Ramos, and Rogo (2017) find that firms that manage earnings to beat prior year earnings are more likely to have a 'Management Discussion and Analysis' section in the annual report that is difficult to read. Bonsall and Miller (2017) find that less readable financial disclosure leads to less favourable bond ratings. We measure the readability of total, systematic and idiosyncratic risk disclosure via the Fog index. We compute interaction effects of the risk disclosure variables and their readability on investor risk perception. For all three risk disclosure variables, we find that firms are perceived to be more risky if risk disclosures are difficult to read.

Next, we analyse the effect of the comparability of risk disclosure. Comparable financial statements allow acquirers to make better acquisition decisions (Chen, Collins, Kravet, & Mergebthaler, 2018), investors to better evaluate future firm performance (Choi, Choi, Myers, & Ziebart, 2019), and analysts to reduce their information acquisition costs and increase the quantity and quality of the information acquired (De Franco, Kothari, & Verdi, 2011). Kim, Kraft, and

Ryan (2013) measure and analyse financial statement comparability relevant to debt market participants and find that comparability reduces participant uncertainty on firm credit risk, enabling them to better price firm risk. Imhof, Seavey, and Watanabe (2018) find that if competition between firms is high, managers protect proprietary information from competitors, which leads to less comparable financial statements. We measure comparability by year of risk disclosure as the cosine similarity of a firm's risk disclosure in the current year and that of the previous year. Firm comparability is measured by taking the median value of all cosine similarities between the risk disclosure of a firm and that of peer firms operating in the same industry. High comparability to peer firms affects the relevance of systematic risk disclosure in that it reduces the positive effect of risk disclosure on investor perception of systematic risk. This is rather intuitive. If firms report market-wide risk factors but their peers do not repeat these risk factors in their annual reports, this means that the systematic risk disclosure is not comparable to that of peers. As a result, investors are then left in doubt and thus the firm is perceived to be riskier.

Our findings have several implications. First, our results confirm previous findings (Linsley & Lawrence, 2007) that annual reports are on average difficult to read. Standards setters have criticised firm disclosures for their lack of clear language (Financial Reporting Council (FRC), 2009). Our results clearly show that use of unreadable and complex language has negative consequences, i.e. firms are perceived to be more risky if their risk disclosures are difficult to read. Thus, regulators should continue pushing firms to provide clear disclosure. Second, managers should continue emphasising meaningful risk disclosure. As our results show, information on firm-specific risk factors is relevant for investors, as it is difficult to access this information from a channel other than that of firm disclosure. In addition, managers should follow regulators' call and put more emphasis on providing clear disclosure. They should emphasise the style of the information communicated to the public to avoid negative side effects.

The present study contributes to the risk disclosure literature in several ways. First, we add to the growing body of literature analysing risk disclosure behaviour of U.K. firms (Abraham & Cox, 2007; Dobler, Lajili, & Zéghal, 2011; Elzahar & Hussainey, 2012; Klaus, 2005; Linsley & Shrives, 2006; Rajab, 2009; Rajab & Handley–Schachler, 2009). Our results show that risk disclosure is relevant and increases investor risk perception. Our results for a sample of U.K. companies are in line with evidence from U.S. companies (Campbell et al., 2014; Kravet & Muslu, 2013). Further,

we show that other external factors and firm characteristics, i.e. analyst coverage, foreign ownership and filing speed of the annual report affect the relevance of risk disclosure.

Second, we contribute to the discussion of the relevance of risk disclosure by presenting results for overall risk disclosure and for systematic and idiosyncratic risk disclosure separately. We follow the call of Heinle and Smith (2017) to distinguish between risk disclosure regarding systematic risk and idiosyncratic risk. In addition, we analyse whether linguistic features of disclosures, namely their readability and comparability, influence their relevance. Thus, we empirically test two enhancing qualitative characteristics of the *Conceptual Framework for Financial Reporting* and find that firms should place more emphasis on reporting in a clear and comprehensive manner. With this study, we enhance previous findings on risk disclosure in U.K. annual reports by, on the one hand, analysing the systematic and idiosyncratic component of risk disclosure in the U.K. setting for the first time. On the other hand, we incorporate previous findings on the comparability and readability of U.K. annual reports into our analysis (Abraham & Shrives, 2014; Linsley & Lawrence, 2007) to further understand the relation between risk disclosure and investor risk perception.

Third, our sample covers the period 2005 to 2017, which, compared to previous studies (Bao & Datta, 2014; Campbell et al., 2014; Kravet & Muslu, 2013), allows us to have enough post–Global Financial Crisis (GFC) data to draw meaningful conclusions on the effect of the GFC on the relation between risk disclosure and investor risk perception. Our results show that during crisis years, the effect of risk disclosure on investor risk perception is stronger. We do not find any enhancing effect for the years following the GFC.

This paper proceeds as follows. Section 5.2 provides an overview of the regulatory and theoretical background of risk disclosure and describes our hypothesis development. Section 5.3 details how the sample is formed and describes the variables and research design. Section 5.4 presents and discusses our results. Section 5.5 describes robustness checks and additional analyses to validate our findings. Finally, Section 5.6 sets forth our conclusions.

5.2. Background and hypothesis development

This section gives an overview of the regulatory and theoretical background, along with our hypothesis formulation.

5.2.1. Regulatory background

U.K. listed companies prepare their financial statements in accordance with IFRS. IFRS 7 requires firms to provide in their financial statements a description of the risks arising from financial instruments. This description should be quantitative and qualitative in nature. Further, companies are strongly encouraged, but not required, to present the principal risks and uncertainties they face in the 'Management Commentary' accompanying their financial statements (IASB, 2010).

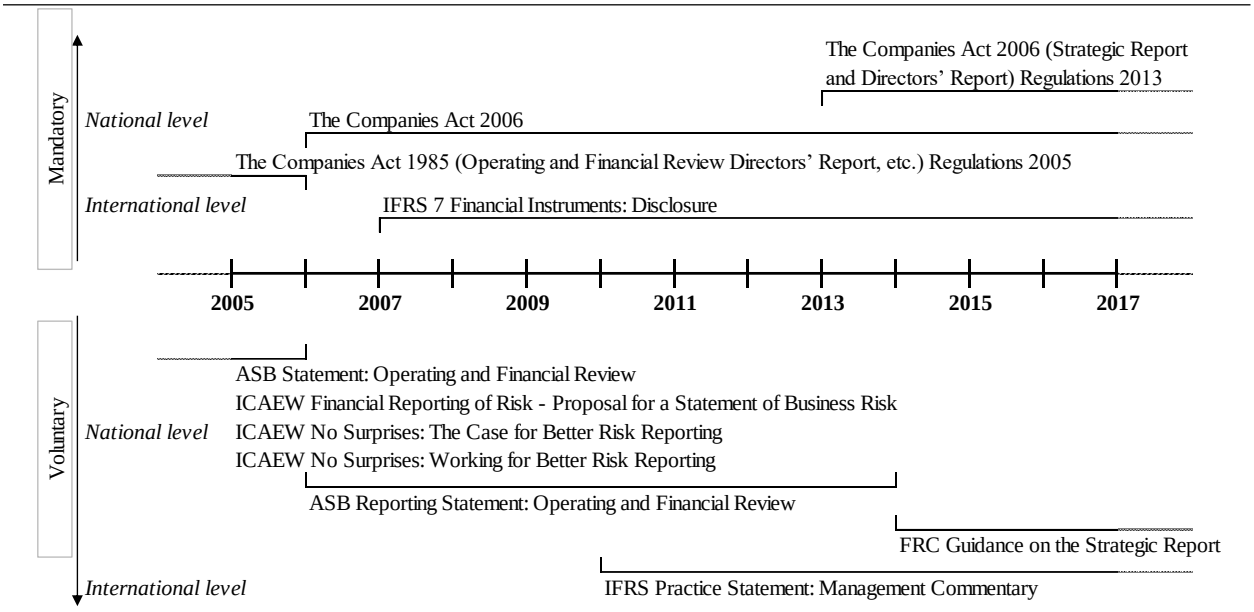
At the country level, the importance of risk reporting has been recognised early (Rajab and Handley-Schachler, 2009). The Institute of Chartered Accountants in England and Wales (ICAEW) issued discussion papers on risk reporting in which they encourage disclosure on risks (ICAEW, 1998, 1999, 2002)[34]. Further, in 1993, the Accounting Standards Board (ASB) issued a proposal for an 'Operating and Financial Review' in which companies are encouraged to discuss their exposure to risk and uncertainties and their efforts in managing these risks (ASB, 1993; Linsley and Shrives, 2000). A new regulation, The Companies Act 1985 (Operating and Financial Review and Directors' Report etc.) Regulations 2005, which mandates U.K. firms to provide an 'Operating and Financial Review' became effective for financial years on or after 1 April 2005. The Operating and Financial Review should contain a review of the firm's principal risks and uncertainties (ASB, 2006). Simultaneously, the ASB issued a reporting standard for the Operating and Financial Review, Reporting Standard 1, in May 2005. However, shortly thereafter in January 2006, the requirement to include an Operating and Financial Review in annual reports was repealed[35]. Subsequently, Reporting Standard 1 was transformed into a best practice statement, with 'persuasive rather than mandatory force' (ASB, 2006, p. 5). In 2006, the commercial law was revised and The Companies Act 2006 became effective in November 2006. The Companies Act 2006 required firms to provide a business review in which the companies describe the principal risks and uncertainties they face. In 2013, a new regulation, The Companies Act 2006 (Strategic Report and Directors' Report) Regulations 2013 was released. It introduced a mandatory strategic

[34] In 1998, the ICAEW issued the discussion paper 'Financial reporting of risk – Proposals for a statement of business risk', and its revisions in 1999 'No Surprises: The Case for Better Risk Reporting' and in 2002 'No Surprises: Working for Better Risk Reporting'.

[35] Rowbottom and Schroeder (2014) provide more detail on the drafting, enacting and controversial repealing of the Operating and Financial Review.

report for U.K. listed companies. The Financial Reporting Council (FRC) issued guidance on the newly mandatory strategic report. In the strategic report, companies should provide an overview of their business strategy, including a description of the risk factors to which they are exposed (FRC, 2014). This best practice statement by the FRC replaced guidance by the ASB on the Operating and Financial Review. Figure 5.1 provides a timeline of the risk reporting regulations over the sample period. In summary, the U.K. risk reporting environment features both mandatory and voluntary elements.

Figure 5.1: Timeline of Risk Reporting Regulations from 2005 to 2017



This figure provides an overview over mandatory and voluntary risk disclosure regulations and guidelines over the sample period, that is, from 2005 to 2017.

5.2.2. Theoretical background

Institutional theory (DiMaggio & Powell, 1983; Oliver, 1991) and legitimacy theory (Ashforth & Gibbs, 1990; Suchman, 1995) help in explaining the risk disclosure behaviour of firms (e.g. Abraham & Shrives, 2014; Al-Hadi, Hasan, & Habib, 2016; Elshandidy, Fraser, & Hussainey, 2015; Ntim, Lindop, & Thomas, 2013). In addition to economic reasons to engage in risk reporting, social and political aspects foster company risk reporting (Abraham & Shrives, 2014). Neo-institutional theory comprises three institutional pressures: regulatory, mimetic and normative (Elshandidy et al., 2015). Regulatory pressure explains why firms engage in mandatory risk

reporting, while mimetic and normative pressure explain why all firms comply with best practice statements that suggest risk reporting beyond what is legally required (Elshandidy et al., 2015). Companies tend to mimic the disclosure behaviour of peer firms, which may explain the critique that disclosures are largely boilerplate (Abraham & Shrives, 2014). Further, companies comply with best practice statements from regulators to gain legitimacy. Firms, which operate within a social construct, seek legitimacy within that construct and thus incorporate the values and norms of that social network (Ntim et al., 2013). Thus, to gain legitimacy, companies comply with risk reporting regulations and disclose information about their risk factors to meet social expectations (Barakat & Hussainey, 2013). Firms are then rewarded with a good reputation and public recognition (Louhichi & Zreik, 2015).

5.2.3. Hypothesis development

5.2.3.1. Relevance of risk disclosure

Prior studies investigate how the stock market reacts to risk disclosure (e.g. Kravet & Muslu, 2013). Three arguments dominate in this research setting. The *divergent argument* suggests that risk disclosure increases investor risk perception as new and unknown risks are communicated through the annual report (Garfinkel, 2009; Kravet & Muslu, 2013). As a result, investors revise their trades, and thus an increase in market activity is observed (Garfinkel, 2009). The counterargument is the *convergent argument*, which states that known risks are resolved and thus investor risk perception decreases (Garfinkel, 2009; Kravet & Muslu, 2013). The third argument, the *boilerplate argument*, is that risk disclosure is not relevant and thus will not provoke a reaction by investors (Kravet & Muslu, 2013).

Prior empirical results are mixed. For a sample of U.S. annual reports, both Kravet and Muslu (2013) and Campbell et al. (2014) find support for the divergent argument; risk disclosure in the annual report increases investor risk perception. Unknown risks and contingencies are communicated by companies through the annual report. Elshandidy and Shrives (2016) complement these findings by distinguishing disclosure of good news and bad news about risk. For disclosure of bad news about risk, these authors find support for the divergence argument, while, for disclosure of good news about risk, they find support for the convergence argument.

Bao and Datta (2014) group risk factor information into 30 risk disclosure topics and find support for all three arguments. Twenty-two out of their 30 risk disclosure topics lack informativeness and thus support the boilerplate argument. Disclosure on three out of the 30 risk types identified, macroeconomic risk, funding risk and credit risk, increase investor risk perception. For human resource risk, regulation change risk, and infrastructure risk, the authors find a negative association with investor risk perception and thus support for the convergence argument. Kravet and Muslu (2013) divide their risk disclosure measure into a firm-specific portion and an industry-specific portion, and find that the influence of industry-level risk disclosure on investor risk perception is substantially higher.

Prior evidence supports mainly the divergence argument, which states that investor risk perception increases as a result of risk disclosure since new and, until then, unknown risks are communicated. Hence, the first step toward better understanding the information content of systematic and idiosyncratic risk disclosure is to analyse whether our data confirms prior findings by showing that risk disclosure influences investor risk perception and is thus relevant. Consistent with prior evidence, we formulate our first hypothesis as follows.

H1: Risk disclosure in annual reports is relevant and increases investor risk perception.

5.2.3.2. Risk disclosure readability

Readable risk information facilitates assessment of the risk position of firms for capital market participants (Linsley & Lawrence, 2007; Linsley, Shrives & Crumpton, 2006). For example, less readable annual reports require greater collective and individual effort by financial analysts to interpret the information conveyed (Lehavy et al., 2011). Low readability affects the accuracy of analyst earnings forecast negatively (Lehavy et al., 2011). Further, investors need to devote more time and effort in interpreting and processing less readable communication (Bloomfield, 2002).

Risk information in U.K. annual reports are difficult to very difficult to read (Linsley & Lawrence, 2007). As pointed out by Linsley and Lawrence (2007), the call for greater risk disclosure (ICAEW, 1998) does not lead to better risk communication unless firms emphasise provision of clear risk information. However, at the same time, directors do not appear to purposely provide unreadable risk disclosure, particularly for bad risk news (Linsley & Lawrence, 2007).

Thus, if risk disclosures are difficult to read, this may lead to increasing the effect of risk disclosure on investor risk perception. The company might appear to be even riskier if the language employed is difficult and not transparent. Employing difficult language when describing risk factors might leave investors and other readers with even more doubt about the financial health of the firm, which in turn is then mirrored in assessments of firm risk. Thus, we expect that risk disclosures that are more difficult to read would worsen assessment of firm riskiness.

5.2.3.3. Risk disclosure comparability with peers

As emphasised by the IASB in the IFRS Conceptual Framework for Financial Reporting, financial information should be comparable to similar information of other companies to enhance its usefulness. Comparable risk disclosures can facilitate the assessment of firm riskiness, because it puts the firm and its risk factors into perspective. Investors can better assess the relative riskiness of firms if disclosures are more similar to those of industry peers, and thus more comparable, because peer companies can serve as a benchmark (Choi et al., 2019).

However, making financial statements comparable makes them inherently similar. Thus, although comparability is desirable, as emphasised by the IASB, similarity between financial statements may lead to undesirable side effects, namely that the information is too general, non-specific and symbolic rather than substantive (Abraham & Shrives, 2014; Day & Woodward, 2004). Consequently, such information will be of limited use and is more likely to be ignored (Abraham & Shrives, 2014).

For a sample of U.K. listed companies, Brochet et al. (2013) find that the comparability of financial statements improves subsequent to mandatory IFRS adoption, which leads to less room for insiders to exploit and benefit from private information. Users of financial statements, namely analysts, incur lower cost of information gathering if the comparability of financial statements is high (De Franco et al., 2011). Choi et al. (2019) find that financial statement comparability enhances the informativeness of stock prices, because future earnings are better reflected in current stock price returns.

5.2.3.4. Risk disclosure comparability with previous-year equivalent

In addition to the comparability to similar information of peers firms, the IASB demands firms to report financial information that is comparable to similar information of the same company from previous periods. Thus, in addition to being comparable to that of peer companies, risk disclosure should be comparable to risk information from other periods. If risk disclosures are comparable or, to a certain extent, similar over time, one could argue that risk factors are resolved (Kravet & Muslu, 2013). If information repeats itself over the years, i.e. if the previous year's risk information is confirmed, uncertainties are resolved and thus the information environment improves (Bozanic & Thevenot, 2015). Alternatively, one could argue that, if risk disclosures are similar over time, i.e. if information repeats itself over the years, it becomes redundant and thus is not informative (Bozanic & Thevenot, 2015).

Based on the above arguments, we expect that risk disclosure readability and risk disclosure comparability with other firms' risk disclosure and the similarity with the firm's previous-year risk disclosure affect the relevance of the information. Thus, we formulate our second, non-directional, hypothesis as follows:

H2: Readability and comparability of risk disclosure affect its relevance.

5.3. Data and variables

5.3.1. Sample and data sources

Our sample includes annual reports of U.K. listed companies for the financial years 2005 to 2017. These are the latest available annual reports in the database. We exclude all financial firms from our sample. In 2005, IFRS became mandatory within the European Union. Thus, to ensure consistency among regulatory disclosure requirements during our sample period, our sample starts with annual reports for the financial year 2005. The annual reports are downloaded from Thomson Reuters Eikon in PDF format and subsequently converted into txt format. Excluding annual reports that cannot be transformed into txt format, and considering the non-availability of control variables, our final sample consists of 8,283 annual reports from 1,225 firms.

All risk disclosure and textual measures are computed using a computer-aided textual analysis approach. The dependent variable and all control variables are obtained from Thomson Reuters Eikon.

Consistent with prior research on risk reporting in U.K. annual reports (e.g. Elshandidy, Fraser, & Hussainey, 2013, 2015; Kang & Gray, 2019), we do not limit our analysis to a particular section of the annual report, but rather, we opt to use the entire annual report. There are two reasons for this. First, the annual reports of U.K. listed companies are not standardized, which means that no template with predefined headings is provided by the regulator. Thus, it is at management's discretion to design the annual report layout. Since there are no predefined sections with consistent naming throughout the annual reports of U.K. listed companies, automated extraction of a risk factor section is very difficult. Previous studies (Campbell et al., 2014; Kravet & Muslu, 2013) that analyse risk disclosure in the U.S. context have opted for an automated extraction of the risk reporting section[36]. Manual extraction of specific sections on the firm's risk exposure (Miihkinen, 2012) is too time-consuming for our sample, which consists of almost 8,300 annual reports. Second, in addition to this technical limitation, we believe that annual reports are understood as a complete and comprehensive document. More specifically, we expect investors and other stakeholders to read and interpret the information contained throughout the annual report and not limit themselves to one particular section, ignoring other potential informative sections on firm risk exposure. We strongly believe that annual reports are prepared as a whole document and should be read and understood as such.

5.3.2. Risk disclosure, readability and similarity measures

5.3.2.1. Risk disclosure variables

RiskDisclosure_total is the number of sentences that contain at least one key word from the risk key word list developed by Elshandidy et al. (2013)[37]. The word list developed by

[36] U.S. companies are required to file their annual report under a specific form, namely the 10-K form. Item 1A of the 10-K form specifically requires firms to report about their risk factors. Item 1A is consistently named 'Risk Factors'. This makes an automated extraction feasible.

[37] The word list contains the following key words: risk*, loss*, decline (declined), decrease (decreased), less, low*, fail (failure), threat, verse (versed; reverse; reversed), viable, against, catastrophe (catastrophic), shortage, unable, challenge (challenges), uncertain (uncertainty; uncertainties), gain (gains), chance (chances), increase (increased), peak (peaked), fluctuate*, differ*, diversify*, probable* and significant*. The asterisk indicates that derivatives of the original word are allowed.

Elshandidy et al. (2013) is based on a selection of annual reports of U.K. listed firms and can therefore be applied to our sample. This captures the amount of risk factor information contained in the annual report. We adopt the modernist view that 'risk' includes both possible negative and possible positive outcomes of events (Linsley and Shrives, 2006).

Since we are further interested in the separate effects of systematic and idiosyncratic risk disclosure, we aim to distinguish and measure systematic risk disclosure and idiosyncratic risk disclosure. Systematic risk disclosure is that information in the annual report that describes risks that are common to all market participants, which means that it describes risks to which all firms are exposed. Idiosyncratic risk disclosure is information that describes risk factors specific to a firm. We first detect all risk-related sentences[38], then we discard all non-risk-related sentences from our corpus of texts. This ensures that our corpus contains only information related to firm exposure to risk factors. Then, for *RiskDisclosure_systematic*, we detect systematic key words from the list of Campbell et al. (2014)[39]. We count the sentences from the risk corpus that contain at least one key word from the systematic key word list. We repeat this procedure for *RiskDisclosure_idiosyncratic*. We count the number of risk-related sentences that contain at least one idiosyncratic key word from Campbell et al. (2014)[40]. For our regression analysis, we use the natural logarithm of *RiskDisclosure_total*, *RiskDisclosure_systematic*, and *RiskDisclosure_idiosyncratic*.

5.3.2.2. Readability variables

The readability of risk information is measured via Gunning's Fog index (Gunning, 1952). The Fog index has been used in recent studies (e.g. Bozanic & Thevenot, 2015; Cassell, Cunningham, & Lisic, 2019; Choudhary, Schloetzer, & Sturgees, 2013; De Franco, Hope, Vyas, & Zhou 2015; Lehavy et al., 2011; Lo et al., 2017; Brennan & Merkl-Davies, 2018) as a proxy for text readability. It is measured as follows:

[38] The risk sentences are detected as reported for the measures *RiskDisclosure_total*. A sentence is classified as risk related if it contains at least one risk key word from the list of Elshandidy et al. (2013).
[39] The systematic key world list by Campbell et al. (2014) includes words such as currency fluctuation, cyclical, natural gas, political climate, price pressure, or seasonal.
[40] The idiosyncratic key word list by Campbell et al. (2014) includes words such as customer concentration, customer service, innovation, management retention, merger, orders, patent, or reliance on key customer/supplier.

$$\text{Fog} = 0.4 * (\text{average sentence length} + 100 * \frac{\text{number of words with 3 syllables or more}}{\text{number of words}})$$

The Fog index measures the complexity of the risk disclosure. The higher the Fog index, the more difficult it is to read the text. *Fog_total* measures the readability of the risk-related sentences extracted. *Fog_syst* and *Fog_idio* measure the readability of the systematic and idiosyncratic risk-related sentences, respectively[41].

3.2.3 Peer comparability

We compare the extracted risk description of a company with the risk disclosure of its industry peers. More precisely, we measure how similar texts, so the information about risk factors, are among peer companies. This allows us to assess whether the risk information published in the annual report of a company is similar and thus comparable to the risk disclosures of other companies operating in the same industry.

Consistent with Lang and Stice-Lawrence (2015), we compare the disclosures of one firm to the disclosures of its peers companies. We compute the median of a firm's cosine similarities with all other firms from our sample that operate in the same industry (Lang and Stice-Lawrence, 2015). To do this, we first group firms by industry and year. Next, we compute the cosine similarity between the risk disclosures of every possible pair of firms. The cosine similarity compares vectors of word counts and is bounded between 0 and 1. A score of 0 suggests that the texts have few common words or phrases, while a score of 1 suggests that the texts are very similar. This measure allows assessing and quantifying how similar two texts are. Finally, for a given firm, we compute the median of all cosine similarities of the risk disclosure of that particular firm with the risk disclosures of its peer firms, so the firms operating in the same industry. A high median value suggests that a firm's disclosure is similar to that of its peers. Before calculating cosine similarities, we remove all numbers and stop words, i.e. very common words, from the texts. *SimilarityPeers_total*, *SimilarityPeers_syst* and *SimilarityPeers_idio* are industry similarities for

[41] We describe how we extract risk related sentences in Subsection 5.3.2.1.

the risk-related sentences, the systematic risk-related sentences and the idiosyncratic risk-related sentences, respectively[42].

5.3.2.4. Year-to-year comparability

To assess comparability between a firm's risk disclosure and that of the previous year, we compute the cosine similarity of the extracted risk-related sentences with its prior year equivalent. This is consistent with Brown and Tucker (2011), Bozanic and Thevenot (2015), and Hoberg and Phillips (2016), who compute the cosine similarity of current and previous year Management Discussion and Analysis, current and previous quarter earnings press release and current and previous year business description, respectively. We remove all numbers and stop words before calculating the cosine similarities. This enables us to assess the how similar and thus comparable the information on risk factors is to the risk disclosure from the previous period. SimilarityYears_total, SimilarityYears_syst and SimilarityYears_idio are the year-to-year similarities of the risk-related sentences, the systematic risk-related sentences and the idiosyncratic risk-related sentences, respectively.

5.3.3. Model specification, dependent variable and control variables

5.3.3.1. Investor risk perception

In contrast to previous studies (e.g. Campbell et al., 2014), which measure the relationship between risk disclosure and pre-disclosure proxies for firm risk, we focus only on the association between risk disclosure and post-disclosure assessment of firm risk. We do not test whether our risk disclosure measures are associated with firm risk. We abstain from measuring the true firm risk. We focus only on the market's assessment of firm risk after release of the annual report. Thus, we follow the rationale that firms report their risk factors, then the market incorporates this information into its assessment of firm riskiness if this information is relevant.

We compute three measures of investor assessment of firm risk: perceived total risk (*SDReturns_after*), perceived systematic risk (*Beta_after*) and perceived idiosyncratic risk (*SDResiduals_after*). *SDReturns_after* is the annualised standard deviation of stock returns over

[42] See Loughran and McDonald (2016) for a review of readability and similarity measures employed in the Accounting and Finance literature.

60 days after release of the annual report, starting 3 days after the filing date. It is a market-based proxy for total firm risk, as perceived by the capital markets. *Beta_after* is a proxy for perceived systematic risk. It is estimated from the regression of daily stock returns on the market return over 60 days after release of the annual report, starting 3 days after the filing date. *SDResiduals_after* is a proxy for perceived idiosyncratic risk. It is the standard deviation of the residuals from the regression of stock returns on the market return over 60 days after release of the annual report, starting 3 days after the filing date.

We choose a 60-days window, since the information in the annual report is difficult to digest (Kravet & Muslu, 2013), and thus a shorter window would not be appropriate. However, the 60-day window is sufficiently small to minimize confounding events (Kravet & Muslu, 2013). For example, it does not interfere with yet-to-be-published quarterly reports.

5.3.3.2. Model specifications and control variables

To test H1, we estimate the following Ordinary Least Squares (OLS) regression model:

$$\begin{aligned} FirmRisk\_after_{i,t} = {} & \beta_0 + \beta_1 RiskDisclosure_{i,t} + \beta_2 FirmRisk\_before_{i,t} + \beta_3 FirmSize_{i,t} \\ & + \beta_4 BooktoMarket_{i,t} + \beta_5 Profitability_{i,t} + \beta_6 Leverage_{i,t} \\ & + \beta_7 Loss_{i,t} + \beta_8 TradingVolume_{i,t} + \beta_9 CrossListed_{i,t} \\ & + \beta_{10} Big6Auditor_{i,t} + \beta_{11} EarningsSurprise_{i,t} \\ & + \beta_{12} YearDummies + \beta_{13} IndustryDummies + \varepsilon_{i,t} \end{aligned}$$

To test our second hypothesis, we complete the previous model as follows.

$$\begin{aligned} FirmRisk\_after_{i,t} = {} & \beta_0 + \beta_1 RiskDisclosure_{i,t} + \beta_2 Fog_{i,t} + \beta_3 SimilarityPeers_{i,t} + \beta_4 SimilarityYears_{i,t} \\ & + \beta_5 RiskDisclosure_{i,t} * Fog_{i,t} + \beta_6 RiskDisclosure_{i,t} * SimilarityPeers_{i,t} \\ & + \beta_7 RiskDisclosure_{i,t} * SimilarityYears_{i,t} + \beta_8 FirmRisk\_before_{i,t} \\ & + \beta_9 FirmSize_{i,t} + \beta_{10} BooktoMarket_{i,t} + \beta_{11} Profitability_{i,t} \\ & + \beta_{12} Leverage_{i,t} + \beta_{13} Loss_{i,t} + \beta_{14} TradingVolume_{i,t} \end{aligned}$$

$$+ \beta_{15} CrossListed_{i,t} + \beta_{16} Big6Auditor_{i,t} + \beta_{17} EarningsSurprise_{i,t}$$

$$+ \beta_{18} YearDummies + \beta_{19} IndustryDummies + \varepsilon_{i,t}$$

We measure our dependent and independent variables of interest as described earlier in this section and in Section 5.3.2. *FirmRisk_after* is a substitute for *SDReturns_after*, *Beta_after* and *SDResiduals_after*. *RiskDisclosure* is a substitute for *RiskDisclosure_total*, *RiskDisclosure_systematic* and *RiskDisclosure_idiosyncratic*. In addition to our independent variables of interest, we include a control variable that we expect to influence investor risk perception. *FirmRisk_before* is a substitute for *SDReturns_before*, *Beta_before* and *SDResiduals_before*. These are proxies for perceived firm risk measured over the 60 days preceding the publication of the annual report, starting 3 days before the filing date. Consistent with Campbell et al. (2014) and Bao and Datta (2014), we expect stock movements before the publication of the annual report to influence stock movements after its publication. *FirmSize* is the natural logarithm of the market capitalisation of the firm. Larger firms are expected to be less risky (Campbell et al., 2014; Hope et al., 2016). *BooktoMarket* is the book-to-market ratio (Campbell et al., 2014; Elshandidy & Shrives, 2016; Hope et al., 2016). *Profitability* is the return on assets and *Leverage* is the ratio of the sum of short-term debt and long-term current debt to the common equity of the firm (Elshandidy & Shrives, 2016). *Loss* is a dummy variable taking the value 1 if the firm reported negative net income before tax for the financial year, and 0 otherwise (Kravet & Muslu, 2013). *TradingVolume* is the daily trading volume divided by the number of common shares outstanding. Bao and Datta (2014) and Elshandidy and Shrives (2016) find that trading volume is positively associated with investor risk perception. *CrossListed* is a dummy variable taking the value 1 if the firm is crosslisted in the U.S., i.e. if it has American Depositary Receipts traded on a U.S. exchange, and 0 otherwise. *Big6Auditor* is a dummy variable taking the value 1 if firms are audited by one of the six largest audit companies in the U.K., and 0 otherwise. Auditors play an important monitoring role (Ding, 2016); thus, trust in firms audited by highly reputable audit companies might be greater (Elshandidy, Nero, & Guo, 2018). *EarningsSurprise* is the difference between reported earnings per share and mean forecast earnings per share. Firms may be perceived as more risky if they have volatile earnings.

5.4. Empirical evidence

5.4.1. Descriptive statistics

Table 5.1 reports descriptive statistics for the variables employed in our main regression analysis. Panel A reports descriptive statistics for the dependent variables. The annualised standard deviation of stock returns, *SDReturns_after*, has a mean of 0.441 over the sample period for all firms. Our measure for perceived systematic risk, *Beta_after*, has a mean of 0.354, and our proxy for perceived idiosyncratic risk, *SDResiduals_after*, has a mean of 0.027. On average, firms disclose 174 risk-related sentences. The standard deviation of *RiskDisclosure_total* is 124.137. Thus, there appear to be large differences among our sample with respect to the amount of risk information in the annual report. Firms report, on average, 46 systematic risk-related sentences. Thus, on average, 27% of risk-related sentences are related to systematic, i.e. to market-wide, risks and uncertainties. Some 54 idiosyncratic risk-related sentences occur in the annual reports. Thus, on average, 31% of risk-related sentences are related to idiosyncratic, i.e. firm-specific, topics. Over the sample period and across all firms, firms report, on average, more idiosyncratic risk information than systematic risk information. This can be explained by the fact that the annual report, and firm communications in general, are an important source of firm-specific information. Information on market-wide developments can be obtained from other sources than the firm itself. Thus, firms might be less likely to devote time and effort to such disclosures.

Table 5.1: Descriptive statistics

Panel A: Dependent variable and risk disclosure variables							
	N	Mean	St. Dev.	Min	p25	Median	p75	Max
SDReturns_after	8283	.441	.33	0	.233	.346	.541	1.858
Beta_after	8283	.354	.611	-1.4	0	.265	.691	2.213
SDResiduals_after	8283	.027	.021	0	.014	.021	.033	.115
RiskDisclosure_total	8283	173.618	124.137	2	89	136	219	634
		4.929	*.685*	*.693*	*4.489*	*4.913*	*5.389*	*6.452*
RiskDisclosure_systematic	8283	46.397	38.353	1	21	35	60	211
		3.526	*.828*	*0*	*3.045*	*3.555*	*4.094*	*5.352*
RiskDisclosure_idiosyncratic	8283	54.292	38.962	1	29	44	70	207
		3.737	*.77*	*0*	*3.367*	*3.784*	*4.248*	*5.333*
Panel B: Textual variables								
	N	Mean	St. Dev.	Min	p25	Median	p75	Max
Fog_total	8283	22.402	2.053	18.789	21.27	22.248	23.311	69.672
Fog_syst	8283	25.367	3.48	18.786	23.269	25.032	26.937	73.81
Fog_idio	8283	25.505	3.369	19.079	23.531	25.131	27.054	84.912
ComparabilityPeers_total	8283	.962	.013	.833	.958	.965	.97	.981
ComparabilityPeers_syst	8283	.9	.049	.604	.887	.915	.93	.952
ComparabilityPeers_idio	8283	.91	.046	.582	.9	.924	.936	.96
ComparabilityYears_total	7185	.988	.015	.828	.986	.992	.995	.998
ComparabilityYears_syst	7177	.959	.048	.667	.955	.975	.985	.997
ComparabilityYears_idio	7176	.963	.047	.639	.961	.978	.987	.997
Panel C: Control variables								
	N	Mean	St. Dev.	Min	p25	Median	p75	Max
SDReturns_before	8283	.431	.317	0	.227	.339	.536	1.798
Beta_ before	8283	.341	.616	-1.486	-.009	.247	.685	2.24
SDResiduals_ before	8283	.026	.02	0	.014	.02	.033	.111
FirmSize	8283	4.009	2.277	-1.273	2.367	3.735	5.525	9.962
BooktoMarket	8283	.739	1.039	-3.03	.265	.524	.971	6.25
Profitability	8283	-5.991	31.79	-189.62	-8.07	3.68	8.54	37.26
Leverage	8283	.112	.379	-1.414	0	.021	.13	2.303
Loss	8283	.392	.488	0	0	0	1	1
TradingVolume	8283	.6	.815	.002	.154	.352	.71	5.502
CrossListed	8283	.073	.261	0	0	0	0	1
Big6Auditor	8283	.777	.417	0	1	1	1	1
EarningsSurprise	8283	6.253	32.525	-25.29	-.35	0	1.76	245

This table reports summary statistics for all variables used in our main regression analysis. Panel A reports descriptive statistics for the dependent variable and the risk disclosure variables. The raw values and the natural logarithm of values (in italics) for the risk disclosure variables are displayed. Panel B and panel C report descriptive statistics for the textual variables used as moderators and the control variables, respectively. The sample consists of 8,283 firm–year observations for 1,225 listed non-financial U.K. companies from 2005 to 2017.

Figure 5.2 plots *RiskDisclosure_total*, *RiskDisclosure_systematic* and *RiskDisclosure_idiosyncratic* over the sample period, i.e. from 2005 to 2017, differentiating between industries. Overall, for all three risk disclosure variables, we observe an increase over this time period.

Figure 5.2: Risk Disclosure measure from 2005-2017

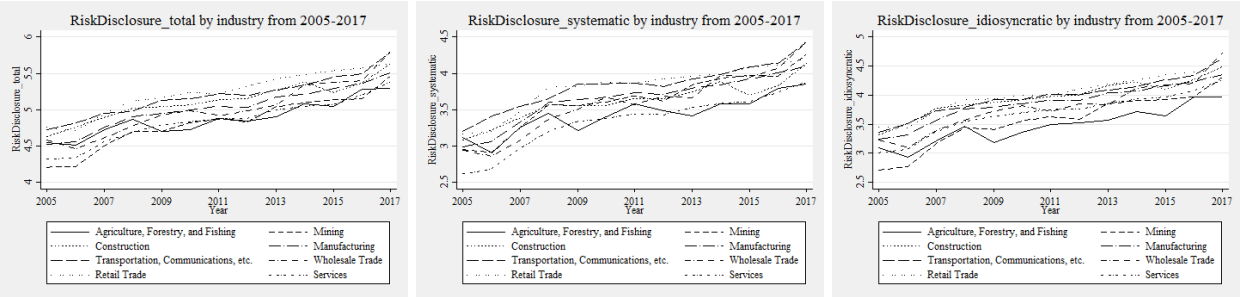


Table 5.2 reports Pearson's correlation coefficients for the dependent variable, the risk disclosure variables and the textual variables.

Table 5.2: Pairwise correlations

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) *SDReturns_after*	1.000														
(2) *Beta_after*	0.053*	1.000													
(3) *SDResiduals_after*	0.995*	0.002	1.000												
(4) *RiskDisclosure_total*	-0.191*	0.318*	-0.222*	1.000											
(5) *RiskDisclosure_systematic*	-0.143*	0.315*	-0.174*	0.940*	1.000										
(6) *RiskDisclosure_idiosyncratic*	-0.169*	0.273*	-0.195*	0.946*	0.900*	1.000									
(7) *Fog_total*	0.018	0.102*	0.012	0.170*	0.234*	0.236*	1.000								
(8) *Fog_syst*	0.057*	0.040*	0.057*	0.066*	0.072*	0.136*	0.791*	1.000							
(9) *Fog_idio*	0.000	0.108*	-0.007	0.184*	0.233*	0.195*	0.858*	0.753*	1.000						
(10) *ComparabilityPeers_total*	-0.057*	0.081*	-0.062*	0.589*	0.548*	0.607*	0.056*	0.014	0.043*	1.000					
(11) *ComparabilityPeers_syst*	-0.025	0.130*	-0.036*	0.682*	0.745*	0.709*	0.223*	0.154*	0.187*	0.744*	1.000				
(12) *ComparabilityPeers_idio*	-0.079*	0.112*	-0.088*	0.684*	0.665*	0.781*	0.202*	0.148*	0.181*	0.795*	0.802*	1.000			
(13) *ComparabilityYears_total*	-0.089*	0.075*	-0.095*	0.405*	0.380*	0.394*	-0.028*	-0.043*	-0.005	0.545*	0.456*	0.467*	1.000		
(14) *ComparabilityYears_syst*	-0.082*	0.118*	-0.092*	0.496*	0.531*	0.493*	0.108*	0.067*	0.114*	0.501*	0.641*	0.536*	0.780*	1.000	
(15) *ComparabilityYears_idio*	-0.102*	0.096*	-0.109*	0.487*	0.468*	0.542*	0.095*	0.073*	0.109*	0.524*	0.534*	0.650*	0.808*	0.769*	1.000

This table reports Pearson's correlation coefficients for the dependent variables, the risk disclosure variables and the textual variables employed in our main analysis. Asterisks indicates significance at the 1% level.

5.4.2. Main analysis

5.4.2.1. Relevance of risk disclosure

Table 5.3 reports results of the test of whether risk disclosure significantly influences investor risk perception (H1). We include year and industry dummies in our regression analysis. Standard errors are Huber–White heteroskedastic robust. All continuous variables are winsorized at the 1st and 99th percentiles.

Table 5.3: Effect of risk disclosure on investor risk perception

Dependent variable:	*SDReturns_after*	*Beta_after*	*SDResiduals_after*
	(1)	(2)	(3)
VARIABLES			
RiskDisclosure_total	0.0403***		
	(5.019)		
RiskDisclosure_systematic		0.0436***	
		(3.692)	
RiskDisclosure_idiosyncratic			0.00199***
			(4.858)
SDReturns_before	0.385***		
	(22.97)		
Beta_before		0.156***	
		(10.46)	
SDResiduals_before			0.392***
			(23.49)
FirmSize	-0.0297***	0.0886***	-0.00195***
	(-10.10)	(17.17)	(-11.79)
BooktoMarket	-0.00708	0.0107	-0.000429
	(-1.529)	(1.470)	(-1.512)
Profitability	-0.000908***	-0.000553*	-5.69e-05***
	(-4.631)	(-1.807)	(-4.718)
Leverage	0.0136	-0.0246	0.000952
	(1.291)	(-1.393)	(1.477)
Loss	0.0508***	0.0128	0.00326***
	(5.540)	(0.736)	(5.783)
TradingVolume	0.0198***	0.0561***	0.00107***
	(4.050)	(5.898)	(3.611)
CrossListed	0.0160	0.0433*	0.000670
	(1.432)	(1.763)	(0.998)
Big6Auditor	-0.0357***	-0.0512***	-0.00203***
	(-3.580)	(-2.776)	(-3.321)
EarningsSurprise	0.000140	0.000341	7.29e-06
	(1.223)	(1.592)	(1.044)
Constant	0.139***	-0.362***	0.0139***
	(3.687)	(-5.241)	(7.205)

Observations	8,283	8,283	8,283
Adjusted R^2	0.361	0.229	0.382
Year dummies	YES	YES	YES
Industry dummies	YES	YES	YES
Robust SE	YES	YES	YES

This table reports results from OLS regression of the effect of risk disclosure on investor risk perception. These results relate to H1. In model (1), the dependent variable is the annualised standard deviation of stock returns over 60 days after publication of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of risk-related sentences in the annual report. In model (2), the dependent variable is the coefficient loading on the market return when regressing stock returns on the market return over 60 days after publication of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of systematic risk-related sentences in the annual report. In model (3), the dependent variable is the standard deviation of residuals from regression of stock returns on the market return over 60 days after publication of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of idiosyncratic risk-related sentences in the annual report. Year and industry dummies are included. Continuous variables are winsorized at the 1st and 99th percentiles. T-statistics are reported in parentheses. Standard errors are heteroskedasticity-robust. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Specification (1) tests the effect of total risk disclosure, measured by *RiskDisclosure_total*, which is the natural logarithm of the number of risk-related sentences in the annual report, on investors' total risk perception, measured by *SDReturns_after*, the annualised standard deviation of stock returns over 60 days starting 3 days after the filing date. *SDReturns_before* is included as a control variable to account for firm risk assessment by investors before the annual report filing. The coefficient on *RiskDisclosure_total* is positive (0.0403) and significant at the 1% level, indicating that risk disclosure is relevant. Further, the positive sign of the coefficient on *RiskDisclosure_total* suggests that investor risk perception increases with more risk disclosure. A one standard deviation increase in *RiskDisclosure_total* leads to a 0.0276 (0.685 * 0.0403) increase in the standard deviation of daily stock returns. Our findings are consistent with Kravet and Muslu (2013) and Bao and Datta (2014). Although firms share information with investors, which should improve the information environment, the nature of the information, i.e. information on risk factors, seems to have the opposite effect; that is, firms are perceived to be more risky if they report extensively about their risk factor exposure. Investors diverge in their opinions rather than converge, and new and unknown risk information is introduced to the market.

Specification (2) of Table 5.3 shows the results of the effect of *RiskDisclosure_systematic*, which is measured as the natural logarithm of the number of systematic risk-related sentences in the annual report, on *Beta_after*, which is a proxy for investor perception of systematic risk. The coefficient on *RiskDisclosure_systematic* is positive (0.0436) and significant at the 1% level. A one standard deviation increase in *RiskDisclosure_systematic* leads to a 0.0361 (0.828 * 0.0436)

increase in the beta coefficient. Thus, our findings for total risk disclosure also hold for market-wide risk information. Information on market-wide risk factors, risk factors that cannot be diversified away, is relevant to investors.

In specification (3), we test the effect of *RiskDisclosure_idiosyncratic*, which is a proxy for idiosyncratic risk-related information, on *SDResiduals_after*, a proxy for investor perception of idiosyncratic risk. The coefficient on *RiskDisclosure_idiosyncratic* is positive (0.00199) and significant at the 1% level suggesting that idiosyncratic risk disclosure is relevant and increases investor perception of idiosyncratic risk. A one standard deviation increase in *RiskDisclosure_idiosyncratic* leads to a 0.0015 (0.77 * 0.00199) increase in the standard deviation of residuals from the regression of daily stock returns on the daily market return. Thus, risk information on firm-specific topics appears to be an important information channel.

For all three specifications, perceived firm risk before publication positively influences perceived firm risk after publication of the annual report[43]. For specifications (1) and (3), *FirmSize* influences firm risk assessment negatively. This suggests that for large firms, investor assessment of overall risk and idiosyncratic risk is low. This might be explained by the intuition that investors know more about large firms. Large firms are publicly exposed, with increased public interest from investors, analysts and the media (Amran, Bin, & Hassan, 2009; Khlif & Hussainey, 2016). Thus, large firms may be perceived as more stable (Campbell et al., 2014; Fama & French, 1993) and more likely to handle risky firm-specific events. For specification (2), the coefficient on *FirmSize* is positive and significant. Thus, perceived systematic risk is higher for large firms. This could result from the fact that large firms constitute a large proportion of the market, and thus, it seems natural that perceived systematic risk is higher for these firms. They are more likely to be exposed to high systematic risk. This may even lead to higher perceived systemic risk, i.e. the risk that an event having a negative influence on a single (large) firm triggers negative consequences for a whole industry or market. Further, the coefficient on *Profitability* is negative and significant; that is, profitable firms are perceived to be less risky. Perceived firm risk seems to be higher for firms

[43] Alternatively to the view that stock movements before the release of the annual report influence stock movements after the release of the annual report (Campbell et al., 2014; Bao and Datta, 2014), one could argue that previous stock movements do not influence future stock movements (Fama, 1995). We redo our analysis excluding perceived firm risk before the release of the annual report. Our results remain largely unchanged and do not alter the inferences that we draw from our results.

that report a loss for a financial year. The coefficient on *Loss* is positive and significant for all three specifications. Consistent with Elshandidy and Shrives (2016), we find a positive and significant coefficient for *TradingVolume*. Firms with high trading volumes are perceived to be riskier. If firms are audited by one of the Big 6 audit companies in the U.K., investor trust seems to be higher.

5.4.2.2. Effect of readability and comparability on risk disclosure relevance

Table 5.4 reports results of the interaction analysis of risk disclosure and its readability and comparability on investor risk perception. Thus, we test whether the readability and comparability of risk disclosure influences its relevance. We include year and industry dummies in our regression analysis. Standard errors are Huber–White heteroskedastic robust and t-statistics are reported in parentheses. All continuous variables are winsorized at the 1st and 99th percentiles.

Table 5.4: Effect of risk disclosure on investor risk perception and the role of readability and comparability of risk disclosure

Dependent variable:	*SDReturns_after*		*Beta_after*		*SDResiduals_after*	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES						
RiskDisclosure_total	0.0352***	0.201				
	(3.450)	(1.155)				
Fog_total	0.00239*	-0.00406**				
	(1.661)	(-2.054)				
*RiskDisclosure_total * Fog_total*		0.00177***				
		(3.245)				
ComparabilityPeers_total	0.413	1.726				
	(1.113)	(1.156)				
*RiskDisclosure_total * ComparabilityPeers_total*		-0.291				
		(-1.051)				
ComparabilityYears_total	-0.184	-0.566				
	(-0.697)	(-0.465)				
*RiskDisclosure_total * ComparabilityYears_total*		0.0699				
		(0.306)				
RiskDisclosure_systematic			0.0734***	0.000127		
			(4.128)	(0.000833)		
Fog_syst			0.00313*	-0.00121		
			(1.833)	(-0.288)		
*RiskDisclosure_systematic * Fog_syst*				0.00144		
				(1.074)		
ComparabilityPeers_syst			-0.811***	-0.307		
			(-3.254)	(-0.687)		
*RiskDisclosure_systematic * ComparabilityPeers_syst*				-0.182		
				(-1.105)		
ComparabilityYears_syst			-0.0581	-0.636		
			(-0.311)	(-1.189)		
*RiskDisclosure_systematic * ComparabilityYears_syst*				0.209		

				(1.133)		
RiskDisclosure_idiosyncratic					0.00160***	-0.00283
					(2.625)	(-0.587)
Fog_idio					0.000101*	-6.31e-05
					(1.777)	(-0.448)
*RiskDisclosure_idiosyncratic * Fog_idio*						5.17e-05
						(1.316)
ComparabilityPeers_idio					0.00471	0.0129
					(0.476)	(0.697)
*RiskDisclosure_idiosyncratic * ComparabilityPeers_idio*						-0.00144
						(-0.252)
ComparabilityYears_idio					0.00333	-0.0102
					(0.540)	(-0.520)
*RiskDisclosure_idiosyncratic * ComparabilityYears_idio*						0.00445
						(0.814)
SDReturns_before	0.388***	0.387***				
	(21.80)	(21.75)				
Beta_before			0.157***	0.157***		
			(9.738)	(9.713)		
SDResiduals_before					0.394***	0.393***
					(22.24)	(22.22)
FirmSize	-0.0277***	-0.0273***	0.0887***	0.0887***	-0.00182***	-0.00183***
	(-8.268)	(-8.036)	(15.44)	(15.32)	(-9.775)	(-9.765)
BooktoMarket	-0.00305	-0.00276	0.0155**	0.0155**	-0.000174	-0.000170
	(-0.623)	(-0.564)	(1.991)	(1.989)	(-0.580)	(-0.567)
Profitability	-0.00110***	-0.00110***	-0.000589*	-0.000589*	-6.97e-05***	-6.96e-05***
	(-5.289)	(-5.272)	(-1.759)	(-1.758)	(-5.418)	(-5.414)
Leverage	0.0127	0.0130	-0.0313	-0.0310	0.000923	0.000917
	(1.088)	(1.114)	(-1.618)	(-1.601)	(1.296)	(1.287)
Loss	0.0407***	0.0401***	0.0207	0.0203	0.00264***	0.00263***
	(4.134)	(4.073)	(1.102)	(1.081)	(4.360)	(4.348)
TradingVolume	0.0197***	0.0200***	0.0620***	0.0620***	0.00108***	0.00108***
	(3.739)	(3.790)	(6.026)	(6.025)	(3.382)	(3.367)
CrossListed	0.0142	0.0131	0.0199	0.0178	0.000391	0.000344
	(1.136)	(1.043)	(0.757)	(0.674)	(0.524)	(0.457)

Big6Auditor	-0.0330***	-0.0318***	-0.0370*	-0.0362*	-0.00192***	-0.00193***
	(-3.030)	(-2.912)	(-1.842)	(-1.803)	(-2.885)	(-2.884)
EarningsSurprise	0.000159	0.000149	0.000265	0.000252	7.55e-06	7.68e-06
	(1.242)	(1.154)	(1.146)	(1.082)	(0.974)	(0.982)
Constant	-0.127	-0.845	0.187	0.403	0.00421	0.0147
	(-0.391)	(-1.001)	(0.924)	(1.037)	(0.546)	(1.095)
Observations	7,185	7,185	7,177	7,177	7,176	7,176
Adjusted R^2	0.367	0.367	0.235	0.235	0.387	0.387
Year dummies	YES	YES	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES	YES	YES
Robust SE	YES	YES	YES	YES	YES	YES

This table reports results from OLS regression of the effect of risk disclosure on investor assessment of firm risk, taking the readability and comparability of risk disclosure into account. This interaction analysis tests H2. In models (1) and (2), the dependent variable is annualised standard deviation of stock returns over 60 days after publication of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of risk-related sentences in the annual report. In model (2), *Fog_total* is a proxy for how difficult it is to understand the risk-related sentences. *ComparabilityPeers_total* and *ComparabilityYears_total* are proxies for the comparability of risk-related sentences among firms and for comparability with previous-period risk-related sentences of a given firm. The interaction terms of the number of risk-related sentences and the three textual measures described are included. In models (3) and (4), the dependent variable is the coefficient loading on the market return when regressing stock returns on the market return over 60 days after release of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of systematic risk-related sentences in the annual report. The interaction terms of systematic risk disclosure and the proxies for readability and comparability are included in model (4). In models (5) and (6), the dependent variable is the standard deviation of the residuals from regression of stock returns on the market return over 60 days after publication of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of idiosyncratic risk-related sentences in the annual report. The interaction terms of systematic risk disclosure and the proxies for readability and comparability are included in model (6). Year and industry dummies are included. Continuous variables are winsorized at the 1st and 99th percentiles. T-statistics are reported in parentheses. Standard errors are heteroskedasticity-robust. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

All three specifications include the risk disclosure variable, the Fog variable as a proxy for the readability of the risk disclosure and two variables that act as proxies for comparability between peer companies and comparability by year of risk disclosure. Interaction terms between risk disclosure variables and readability, comparability between peers and comparability by year, respectively, are included to account for the effect of readability and comparability of the information. To better interpret the results, we compute graphical representations (Figures 5.3, 5.4 and 5.5) of the marginal effects (Brambor, Clark & Golder, 2006) of readability and comparability.

Table 5.4, specifications (1) and (2), report results for the interaction effect of *RiskDisclosure_total* and readability, *Fog_total*, comparability between peer firms, *ComparabilityPeers_tota*l, and comparability by year, *ComparabilityYears_total*. Specification (1) includes single effects and specification (2) includes single effects and interaction effects. *Fog_total*, which is higher for less readable texts, has an enhancing effect on the relation between total risk disclosure and investor risk perception. The interaction term *RiskDisclosure_total* * *Fog_total* is positive (0.00177) and significant at the 1% level. If the risk disclosure provided in the annual report is difficult to read, the firm is perceived to have greater risk. Neither comparability between peer firms nor comparability by year has an effect on the association between total risk disclosure and investor risk perception. The interaction terms *RiskDisclosure_total* * *ComparabilityPeers_total* and *RiskDisclosure_total* * *ComparabilityYears_total* are not significant.

Figure 5.3: Marginal effect of readability and comparability on effect of total risk disclosure on investor risk perception

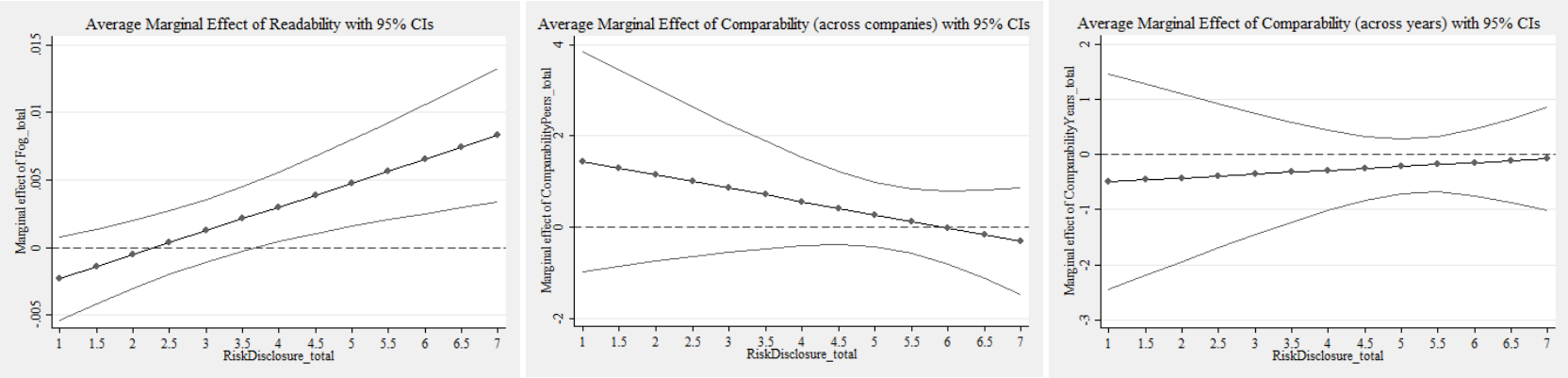


Figure 5.4: Marginal effect of readability and comparability on effect of systematic risk disclosure on investor systematic risk perception

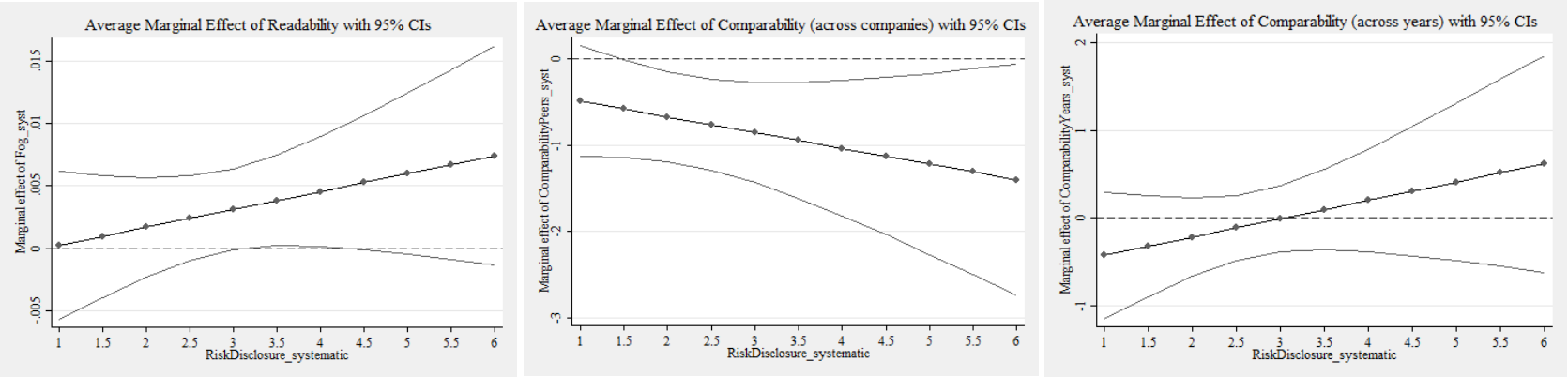


Figure 5.5: Marginal effect of readability and comparability on effect of idiosyncratic risk disclosure on investor idiosyncratic risk perception

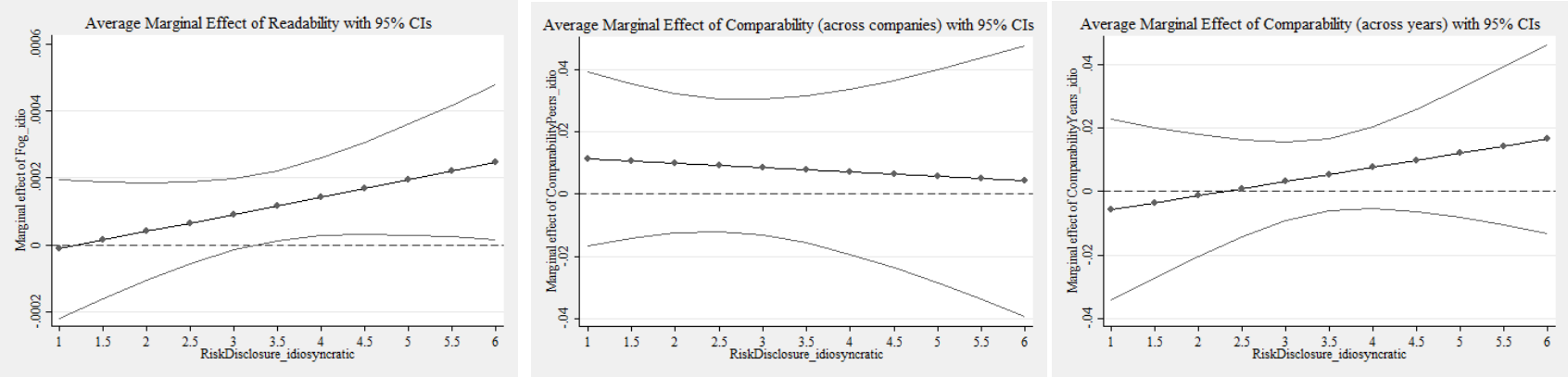


Figure 5.3 plots the marginal effect of readability and comparability on the relation between *RiskDisclosure_total* and *SDReturns_after*. The first plot shows the enhancing effect of risk disclosure readability on its relevance. If the risk disclosures published by the firm are difficult to read, investor risk perception increases. Thus, firms seem even riskier if management is not able to communicate its risk factor exposure in a clear and understandable way. However, these results do not hold for firms that report little about their risk factor exposure; the readability of risk information does not influence the relation between risk disclosure and investor risk perception. Thus, if the firm reports in detail its risk factors and these disclosures are difficult to read, the firm seems particularly risky. The second and third plots show that neither comparability across companies nor comparability across years significantly influences the relation between risk disclosure and investor risk perception.

Table 5.4, specifications (3) and (4), reports results from the interaction analysis of systematic risk disclosure, *RiskDisclosure_systematic* and readability, *Fog_syst*, comparability between peer firms, *ComparabilityPeers_syst*, and comparability by year, *ComparabilityYears_syst*. The interaction terms *RiskDisclosure_systematic * Fog_syst*, *RiskDisclosure_systematic * ComparabilityPeers_syst* and *RiskDisclosure_systematic * ComparabilityYears_syst* are not significant. This suggests that neither readability nor comparability of systematic risk disclosure affects its relevance. To better understand these results, Figure 5.4 plots the marginal effects of readability and comparability on the relation between *RiskDisclosure_systematic* and *Beta_after*.

The first plot shows that readability seems to affect the positive relation between systematic risk disclosure and investor perceived systematic risk only around the median value of *RiskDisclosure_systematic* (3.56). The second plot shows the average marginal effect of comparability across firms on the relevance of systematic risk disclosure. The comparability of systematic risk disclosure across companies, *ComparabilityPeers_syst*, negatively affects the positive relation between systematic risk disclosure and investor perceived systematic risk. However, this relation does not hold for very small or very large values of *RiskDisclosure_systematic*. Our results suggest that, if the information provided on market-wide risk factors is comparable to that of peers, investors are confirmed in their expectations. Thus, the unknown risks that are communicated are put into context. Market-wide risk factors might repeat themselves across firms, and thus the positive relation decreases. Although the communicated risk

factors are new information for a particular firm, the information might not be new overall. Investors may have read about these risk factors in peer company annual reports. On the contrary, if a firm's information on systematic risk is not comparable or in line with that of other firms, investors become sceptical as to why the firm does not report market-wide risk factors, and thus the firm is perceived to be riskier. Year-to-year comparability does not seem to play a role; it does not affect the relevance of systematic risk disclosure.

Specifications (5) and (6) of Table 5.4 report results of the interaction analysis of idiosyncratic risk disclosure, *RiskDisclosure_idiosyncratic*, readability, *Fog_idio*, comparability between peer firms, *ComparabilityPeers_idio*, and comparability by year, *ComparabilityYears_idio*. The interaction terms *RiskDisclosure_idiosyncratic* * *Fog_idio*, *RiskDisclosure_idiosyncratic* * *ComparabilityPeers_idio* and *RiskDisclosure_idiosyncratic* * *ComparabilityYears_idio* are not significant. Figure 5.5 plots the marginal effect of understandability and comparability on the relation between *RiskDisclosure_idiosyncratic* and *SDResiduals_after*.

The first plot shows that if idiosyncratic risk disclosures are difficult to read, perceived firm-specific risk increases. These results do not hold for values of *RiskDisclosure_idiosyncratic* that are below the 25th percentile. Comparability does not influence the relevance of idiosyncratic risk disclosure.

Overall, our results suggest that the readability of risk disclosure influences its relevance. Firms are perceived to be riskier if the risk information published by the firm is difficult to understand. Further, comparability across firms seems to be important only to the relevance of systematic risk disclosure.

5.5. Robustness checks and additional analysis

This section presents additional analyses to validate our findings. Subsection 5.5.1 presents robustness checks to validate our results, and Subsection 5.5.2 presents results of additional analyses on the effect of risk disclosure on investor risk perception.

5.5.1. Robustness checks

This subsection describes several robustness checks. First, we present an alternative treatment of outliers. Second, we mitigate any reverse causality concern via a lead–lag approach, and we

tackle general endogeneity concerns via an instrumental variable estimation. Third, we present alternative measures of risk disclosure to determine whether our results hold.

5.5.1.1. Treatment of outliers

Table 5.5 reports results for our main analysis, whether risk disclosure influences investor risk perception, via an alternative regression specification to determine whether our results remain unaffected. We use quantile regression estimation, which is robust to outliers and extreme values (Chi, Huang, & Xie, 2015; Chiang & Li, 2002; Rejeb & Arfaoui, 2016).

Table 5.5: Effect of risk disclosure on investor risk perception
Robustness check: Quantile regressions

Dependent variable:	*SDReturns_after*	*Beta_after*	*SDResiduals_after*
	(1)	(2)	(3)
VARIABLES			
RiskDisclosure_total	0.0250***		
	(8.762)		
	(5.000)		
RiskDisclosure_systematic		0.0553***	
		(6.406)	
		(5.831)	
RiskDisclosure_idiosyncratic			0.00122***
			(6.385)
			(4.648)
SDReturns_before	0.414***		
	(29.29)		
	(22.36)		
Beta_before		0.178***	
		(18.00)	
		(12.74)	
SDResiduals_before			0.429***
			(29.07)
			(24.14)
FirmSize	-0.0143***	0.0849***	-0.00100***
	(-12.70)	(21.40)	(-14.49)
	(-8.050)	*(19.68)*	*(-10.94)*
BooktoMarket	-6.12e-06	0.00398***	6.15e-06
	(-0.0100)	(4.604)	(0.187)
	(-0.00389)	*(2.224)*	*(0.0691)*
Profitability	1.53e-05	3.77e-05	8.87e-07
	(0.0476)	(0.0877)	(0.0435)
	(0.0786)	*(0.228)*	*(0.0748)*
Leverage	-0.000832	0.00284***	-5.81e-05

	(-0.672)	(3.646)	(-0.881)
	(-0.696)	*(1.578)*	*(-0.733)*
Loss	0.0503***	0.0387*	0.00321***
	(4.232)	(1.815)	(4.300)
	(6.128)	*(2.565)*	*(6.456)*
TradingVolume	0.000203	-0.000111	1.30e-05
	(0.123)	(-0.0339)	(0.122)
	(0.776)	*(-0.153)*	*(0.790)*
CrossListed	-0.00710	0.0610**	-0.000500*
	(-1.633)	(2.431)	(-1.952)
	(-1.206)	*(2.308)*	*(-1.613)*
Big6Auditor	-0.0281***	-0.0420***	-0.00157***
	(-3.628)	(-2.945)	(-3.212)
	(-3.652)	*(-2.654)*	*(-3.137)*
EarningsSurprise	5.40e-06	-3.13e-06	3.36e-07
	(0.354)	(-0.154)	(0.395)
	(1.347)	*(-0.241)*	*(1.453)*
Constant	0.117***	-0.308***	0.0102***
	(6.904)	(-2.836)	(7.475)
	(5.226)	*(-3.643)*	*(8.069)*
Observations	8,283	8,283	8,283
Year dummies	YES	YES	YES
Industry dummies	YES	YES	YES

This table reports results from quantile regression estimates to reduce the effect of outliers. In model (1), the dependent variable is the annualised standard deviation of stock returns over 60 days after publication of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of risk-related sentences in the annual report. In model (2), the dependent variable is the coefficient loading on the market return when regressing stock returns on the market return over 60 days after publication of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of systematic risk-related sentences in the annual report. In model (3), the dependent variable is the standard deviation of residuals from the regression of stock returns on the market return over 60 days after publication of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of idiosyncratic risk-related sentences in the annual report. Year and industry dummies are included. Continuous variables are winsorized at the 1st and 99th percentiles. T-statistics from heteroskedasticity-robust standard errors are reported in parentheses. T-statistics from 999 bootstrap replications to estimate the standard errors are reported in parentheses in italics. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

The results shown in Table 5.5 remain largely unchanged from our main results set forth in Table 5.3. Total risk disclosure influences investor risk perception. Further, systematic (idiosyncratic) risk disclosure influences investor perceived systematic (idiosyncratic) risk. Thus, our results from Table 5.3 are not driven by extreme values.

5.5.1.2. Endogeneity

To respond to any reverse causality concerns, i.e. that investor risk assessment influences company risk disclosure behaviour and not vice-versa, we use a lead–lag approach. Consistent

with Lim, Chalmers, and Hanlon (2018) and Hasan (2020), we rerun our main regression from Table 5.3 by lagging all independent variables by one year.

Table 5.6: Effect of risk disclosure on investor risk perception
Robustness check: Endogeneity

Approach:	Lagged independent variables			Instrumental variables		
Dependent variable:	*SDReturns_after*	*Beta_after*	*SDResiduals_after*	*SDReturns_after*	*Beta_after*	*SDResiduals_after*
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES						
RiskDisclosure_total	0.0138			0.0336***		
	(1.500)			(2.709)		
RiskDisclosure_systematic		0.0268*			0.0440**	
		(1.900)			(2.321)	
RiskDisclosure_idiosyncratic			0.00136***			0.00212***
			(2.923)			(3.465)
SDReturns_before	0.253***			0.389***		
	(13.82)			(21.89)		
Beta_before		0.143***			0.159***	
		(8.796)			(9.863)	
SDResiduals_before			0.254***			0.393***
			(13.75)			(22.22)
FirmSize	-0.0214***	0.0941***	-0.00167***	-0.0266***	0.0911***	-0.00185***
	(-6.580)	(15.08)	(-9.029)	(-7.218)	(14.30)	(-9.303)
BooktoMarket	-0.00777	0.0117	-0.000565*	-0.00268	0.0157**	-0.000186
	(-1.608)	(1.325)	(-1.888)	(-0.542)	(1.998)	(-0.615)
Profitability	-0.000825***	-0.000648*	-5.19e-05***	-0.00110***	-0.000638*	-6.96e-05***
	(-3.872)	(-1.899)	(-3.921)	(-5.299)	(-1.912)	(-5.431)
Leverage	0.00806	-0.0377**	0.000464	0.0129	-0.0315	0.000908
	(0.650)	(-1.970)	(0.611)	(1.113)	(-1.632)	(1.278)
Loss	0.0729***	0.00912	0.00458***	0.0422***	0.0180	0.00269***
	(6.768)	(0.471)	(6.888)	(4.294)	(0.967)	(4.461)
TradingVolume	0.0197***	0.0568***	0.000985***	0.0198***	0.0609***	0.00107***
	(3.767)	(4.884)	(3.100)	(3.767)	(5.923)	(3.356)
CrossListed	-0.00281	0.0361	-0.000806	0.0120	0.0304	0.000317
	(-0.219)	(1.319)	(-1.044)	(0.979)	(1.160)	(0.430)
Big6Auditor	-0.0489***	-0.0435**	-0.00316***	-0.0311***	-0.0425**	-0.00193***
	(-4.014)	(-2.041)	(-4.225)	(-2.798)	(-2.073)	(-2.874)

EarningsSurprise	-6.17e-06	0.000361*	-1.48e-06	0.000140	0.000284	6.88e-06
	(-0.0450)	(1.666)	(-0.176)	(1.112)	(1.230)	(0.896)
Constant	0.275***	-0.357***	0.0185***	0.137***	-0.419***	0.0123***
	(6.165)	(-4.695)	(8.127)	(2.775)	(-5.708)	(5.465)
Observations	6,746	6,738	6,738	7,185	7,177	7,176
Adjusted R^2	0.274	0.226	0.291	0.367	0.234	0.386
Year dummies	YES	YES	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES	YES	YES
Robust SE	YES	YES	YES	YES	YES	YES

This table addresses endogeneity concerns. In models (1) – (3), we use OLS regression estimations with one-year lag of our independent variables to handle any reverse causality concerns. In models (4) – (6), we use an instrumental variable estimation to respond to any endogeneity concerns. In model (1), the dependent variable is annualised standard deviation of stock returns over 60 days after release of the annual report, starting 3 days after the filing date. The independent variable of interest is the one-year lag of the natural logarithm of the number of risk-related sentences in the annual report. In model (2), the dependent variable is the coefficient loading on the market return when regressing stock returns on the market return over 60 days after release of the annual report, starting 3 days after the filing date. The independent variable of interest is one-year lag of the natural logarithm of the number of systematic risk-related sentences in the annual report. In model (3), the dependent variable is the standard deviation of the residuals from regression of stock returns on the market return over 60 days after release of the annual report, starting 3 days after the filing date. The independent variable of interest is the one-year lag of the natural logarithm of the number of idiosyncratic risk-related sentences in the annual report. For models (4) – (6), we introduce two instrumental variables for our risk disclosure variables. For the first instrument, we use mean value of the risk disclosure variables of all firms in the same industry, excluding the firm itself. For the second instrument, we use lag of the risk disclosure variable. We use the same approach for all three risk disclosure variables, i.e. *RiskDisclosure_total*, *RiskDisclosure_systematic* and *RiskDisclosure_idiosyncratic*. Year and industry dummies are included. Continuous variables are winsorized at the 1st and 99th percentiles. T-statistics are reported in parentheses. Standard errors are heteroskedasticity-robust. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Models (1) to (3) of Table 5.6 report results of our lead–lag regressions. Our results remain largely unchanged. Systematic risk disclosure and idiosyncratic risk disclosure are relevant and increase investor risk perception. The results for total risk disclosure are not robust to this specification. To further investigate this finding and to tackle endogeneity concerns, we use an instrumental variable approach. We test whether our three risk disclosure variables are potentially endogenous. We redo our main analysis using instruments for all three regressions. More specifically, we use a two-step efficient generalized method of moments (GMM) estimator with heteroscedasticity-robust standard errors. We identify two instruments for each of the three potential endogenous variables in our three main regressions. These instruments should be correlated with the potentially endogenous variable, but not with the dependent variable. In the first regression, which regresses investor risk perception on total risk disclosure and on the control variables, we model two instrumental variables for *RiskDisclosure_total*. First, we use the mean value of *RiskDisclosure_total* for all firms in the same industry, excluding the firm itself. This is consistent with Lang and Stice-Lawrence (2015). Firms in the same industry exhibit similar risk disclosure behaviour. However, the disclosure behaviour of peer companies does not affect the risk assessment of the subject company. We then use the lag of *RiskDisclosure_total* as the second instrument. We perform Hansen's test for overidentifying restrictions and find that our instruments are valid (Hansen J statistic of 0.141 with a *p*-value of 0.7078). In addition, we find that the rank condition is satisfied and that we do not have a weak instrument problem (F-statistic of 273.17). We further test our initial measure *RiskDislcosure_total* for endogeneity. The results of the Durbin–Wu–Hausman test suggest that we cannot reject the hypothesis that *RiskDisclosure_total* is exogenous. Thus, we confirm that our risk disclosure measure is not endogenous. This is in line with our argument that risk disclosure affects market assessment of firm risk and not vice-versa. For *RiskDisclosure_systematic* and *RiskDisclosure_idiosyncratic*, we proceed in the same way. For both measures, we compute the two instruments and estimate a two-step GMM model with heteroscedasticity-robust standard errors. Our results are similar to those for total risk disclosure. The Kleibergen–Paap rank test for both models suggests that the rank condition is satisfied. In addition, the instruments are valid; we find a Hansen J statistic of 1.767 with a *p*-value of 0.1837 for *RiskDisclosure_systematic* and a Hansen J statistic of 0.431 with a *p*-value of 0.5114 for *RiskDisclosure_idiosyncratic* and their respective instruments. Further, the instruments do not suffer from a weak instruments problem (F-statistic of 827.81 and 526.55, respectively). Our

results show that the two measures *RiskDisclosure_systematic* and *RiskDisclosure_idiosyncratic* are not endogenous, but rather exogenous. This suggests that the estimations from the OLS regressions are correctly specified and are not outperformed by the IV regressions. Table 5.6, model (4) to (6), reports IV regression results. Results are similar to the results reported for the lead–lag regressions. Systematic risk disclosure and idiosyncratic risk disclosure are relevant and increase investor perception of market-wide and firm-specific risk, respectively. In contrast to the results from the lead–lag approach, total risk disclosure is significant and increases investor risk perception. Overall, we conclude that our OLS models are correctly specified and thus, for our additional analysis (Section 5.5.2), we employ OLS regression models.

5.5.1.3. Alternative measures of risk disclosure

Table 5.7 reports results of the test of H1 with alternative measures for all three risk disclosure variables. Specifications (1)–(3) test whether overall risk disclosure is relevant, and if so, whether it increases or decreases investor risk perception. In specification (1), *RiskDisclosure_total* is measured as described in Subsection 5.3.2 and scaled by the natural logarithm of the number of sentences in the annual report. Thus, in specification (1), the overall length of the annual report is taken into account. In specification (2), *RiskDisclosure_total* is measured by the natural logarithm of the number of words in the risk-related sentences. In contrast to our main measure, we use words instead of sentences as a coding unit here. In specification (3), we measure risk disclosure by the natural logarithm of the number of risk key words from Elshandidy et al. (2013)[44]. The results from Table 5.3 are confirmed; risk disclosure is relevant and increases investor risk perception. The coefficients for all three alternative variables are positive and significant.

[44] See footnote 37 for the complete list of key words.

Table 5.7: Effect of risk disclosure on investor risk perception
Robustness check: Alternative measures of risk disclosure

Dependent variable:	*SDReturns_after*			*Beta_after*			*SDResiduals_after*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES									
RiskDisclosure_total	0.380***	0.0421***	0.0408***						
	(3.400)	(5.266)	(5.077)						
RiskDisclosure_systematic				0.174*	0.0438***	0.0440***			
				(1.847)	(3.830)	(4.084)			
RiskDisclosure_idiosyncratic							0.0136***	0.00203***	0.00186***
							(3.919)	(5.419)	(4.910)
SDReturns_before	0.387***	0.385***	0.385***						
	(23.10)	(22.95)	(22.97)						
Beta_before				0.158***	0.156***	0.156***			
				(10.58)	(10.46)	(10.46)			
SDResiduals_before							0.393***	0.392***	0.392***
							(23.59)	(23.47)	(23.50)
FirmSize	-0.0241***	-0.0306***	-0.0298***	0.0949***	0.0882***	0.0877***	-0.00173***	-0.00200***	-0.00193***
	(-9.927)	(-10.20)	(-10.09)	(20.11)	(17.11)	(17.08)	(-11.82)	(-12.01)	(-11.99)
BooktoMarket	-0.00585	-0.00738	-0.00718	0.0127*	0.0106	0.0100	-0.000378	-0.000437	-0.000412
	(-1.271)	(-1.594)	(-1.550)	(1.744)	(1.455)	(1.377)	(-1.340)	(-1.546)	(-1.460)
Profitability	-0.000908***	-0.000905***	-0.000909***	-0.000554*	-0.000544*	-0.000556*	-5.71e-05***	-5.67e-05***	-5.71e-05***
	(-4.625)	(-4.617)	(-4.632)	(-1.806)	(-1.774)	(-1.817)	(-4.728)	(-4.701)	(-4.741)
Leverage	0.0144	0.0134	0.0135	-0.0229	-0.0249	-0.0248	0.000989	0.000941	0.000969
	(1.371)	(1.274)	(1.282)	(-1.301)	(-1.412)	(-1.408)	(1.533)	(1.459)	(1.504)
Loss	0.0509***	0.0498***	0.0503***	0.0136	0.0110	0.0129	0.00327***	0.00320***	0.00325***
	(5.543)	(5.430)	(5.486)	(0.779)	(0.628)	(0.739)	(5.814)	(5.685)	(5.778)
TradingVolume	0.0203***	0.0197***	0.0197***	0.0572***	0.0560***	0.0557***	0.00109***	0.00106***	0.00108***
	(4.164)	(4.027)	(4.043)	(6.007)	(5.890)	(5.855)	(3.694)	(3.597)	(3.642)
CrossListed	0.0195*	0.0158	0.0158	0.0496**	0.0433*	0.0432*	0.000872	0.000631	0.000685
	(1.739)	(1.419)	(1.415)	(2.015)	(1.763)	(1.762)	(1.296)	(0.941)	(1.018)

Big6Auditor	-0.0304***	-0.0362***	-0.0355***	-0.0431**	-0.0510***	-0.0521***	-0.00183***	-0.00206***	-0.00202***
	(-3.104)	(-3.621)	(-3.569)	(-2.345)	(-2.765)	(-2.823)	(-3.016)	(-3.376)	(-3.300)
EarningsSurprise	0.000133	0.000141	0.000139	0.000336	0.000343	0.000350	7.08e-06	7.46e-06	7.43e-06
	(1.167)	(1.235)	(1.214)	(1.564)	(1.603)	(1.635)	(1.015)	(1.068)	(1.064)
Constant	0.0135	-0.0105	0.124***	-0.356***	-0.521***	-0.378***	0.0121***	0.00667***	0.0137***
	(0.171)	(-0.180)	(3.159)	(-4.774)	(-5.875)	(-5.442)	(5.400)	(2.590)	(6.998)
Observations	8,283	8,283	8,283	8,283	8,283	8,283	8,283	8,283	8,283
Adjusted R^2	0.360	0.362	0.362	0.228	0.229	0.229	0.381	0.382	0.382
Year dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Robust SE	YES	YES	YES	YES	YES	YES	YES	YES	YES

This table reports results from the OLS regression of the effect of risk disclosure on investor assessment of firm risk with alternative risk disclosure variables. In models (1)–(3), the dependent variable is the annualised standard deviation of stock returns over 60 days after release of the annual report, starting 3 days after the filing date. In model (1), the independent variable of interest is *RiskDisclosure_total* from Table 3, scaled by the length of the annual report. It is the natural logarithm of the number of risk-related sentences divided by the natural logarithm of the total number of sentences in the annual report. In model (2), *RiskDisclosure_total* is the natural logarithm of the number of words in risk-related sentences and in model (3), it is the natural logarithm of the number of risk key words from Elshandidy et al. (2013). In models (4)–(6), the dependent variable is the coefficient loading on the market return when regressing stock returns on the market return over 60 days after release of the annual report, starting 3 days after the filing date. In model (4), *RiskDisclosure_systematic* from Table 3 is scaled by the natural logarithm of the total number of sentences in the annual report. In model (5), the independent variable of interest is the natural logarithm of the number of words in the systematic risk-related sentences, and in model (6) it is the natural logarithm of the number of systematic key words in the risk-related sentences. In models (7)–(9), the dependent variable is the standard deviation of the residuals from the regression of stock returns on the market return over 60 days after release of the annual report, starting 3 days after the filing date. In model (7), *RiskDisclosure_idiosyncratic* from Table 3 is scaled by the length of the annual report, i.e. the natural logarithm of the number of sentences. In model (8), the independent variable of interest is the natural logarithm of the number of words in the idiosyncratic risk-related sentences, and in model (9), it is the natural logarithm of the number of idiosyncratic key words in the risk-related sentences. Key words are taken from Campbell et al. (2014). Year and industry dummies are included. Continuous variables are winsorized at the 1st and 99th percentiles. T-statistics are reported in parentheses. Standard errors are heteroskedasticity-robust. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Specifications (4)–(6) include alternative measures for *RiskDisclosure_systematic*. In specification (4), *RiskDisclosure_systematic* from our main regression (Table 5.3) is scaled by the natural logarithm of the number of sentences in the annual report. In specification (5), we measure systematic risk disclosure via the natural logarithm of the number of words in the systematic risk-related sentences. In specification (6), we measure *RiskDisclosure_systematic* by the natural logarithm of the number of systematic key words from Campbell et al. (2014) in the risk-related sentences. The coefficients for all three variables are positive and significant, which confirms our previous results. Specifications (7)–(9) include *RiskDisclosure_idiosyncratic* from the main model, scaled by the length of the annual report (specification (7)), the natural logarithm of the number of words in the idiosyncratic risk-related sentences (specification (8)) and the natural logarithm of the number of idiosyncratic key words (see Campbell et al., 2014) in the risk-related sentences (specification (9)). The coefficients on all alternative measures for *RiskDisclosure_idiosyncratic* are positive and significant, confirming our previous finding that idiosyncratic risk disclosure is relevant. We redo our analysis to test H2 with the alternative measures for all three risk disclosure variables. For the sake of brevity, we do not report the results[45]. Our previous findings are confirmed for all nine alternative measures.

5.5.2. Additional analysis

This subsection analyses whether the GFC affects the strength of the relation between risk disclosure and investor risk perception (Subsection 5.5.2.1). Further, we test whether the relation changes if we group firms by their characteristics (Subsection 5.5.2.2).

5.5.2.1. The GFC

In Table 5.8, we test whether the effect of risk disclosure on investor risk perception is stronger during or after the GFC than before it. We introduce two dummy variables, *DuringFinancialCrisis*, which takes the value 1 for financial years 2007 and 2008, 0 otherwise, and *AfterFinancialCrisis*, which takes the value 1 for financial years 2009 to 2017, and 0 otherwise. With this additional test, we test whether our results are stronger for the GFC years, two financial periods in which we expect firms to report more about their risk factor exposure. Companies might be more likely to disclose more to reassure investors and other stakeholders (Malafronte, Porzio, & Starita, 2016).

[45] The results are available upon request.

Further, companies tend to disclose more bad news during and after the GFC (Elshandidy & Shrives, 2016).

Table 5.8: Effect of risk disclosure on investor risk perception
Additional analysis: Effect during and after the Global Financial Crisis

Dependent variable:	*SDReturns_after*	*Beta_after*	*SDResiduals_after*
	(1)	(2)	(3)
VARIABLES			
RiskDisclosure_total	0.0314***		
	(2.944)		
RiskDisclosure_systematic		0.0407**	
		(2.294)	
RiskDisclosure_idiosyncratic			0.00127**
			(2.283)
DuringFinancialCrisis	-0.0984	-0.0225	-0.00261
	(-1.208)	(-0.306)	(-0.789)
*RiskDisclosure_total * DuringFinancialCrisis*	0.0402**		
	(2.429)		
*RiskDisclosure_systematic * DuringFinancialCrisis*		-0.0189	
		(-0.849)	
*RiskDisclosure_idiosyncratic * DuringFinancialCrisis*			0.00234***
			(2.634)
AfterFinancialCrisis	0.0256	-0.0805	5.95e-06
	(0.466)	(-1.172)	(0.00251)
*RiskDisclosure_total * AfterFinancialCrisis*	-0.00192		
	(-0.176)		
*RiskDisclosure_systematic * AfterFinancialCrisis*		0.00340	
		(0.172)	
*RiskDisclosure_idiosyncratic * AfterFinancialCrisis*			0.000327
			(0.527)
SDReturns_before	0.379***		
	(22.79)		
Beta_before		0.159***	
		(10.64)	
SDResiduals_before			0.386***
			(23.40)
FirmSize	-0.0291***	0.0855***	-0.00192***
	(-9.798)	(16.57)	(-11.51)
BooktoMarket	-0.00737	0.0123*	-0.000453
	(-1.597)	(1.690)	(-1.604)
Profitability	-0.000908***	-0.000519*	-5.69e-05***
	(-4.632)	(-1.686)	(-4.723)
Leverage	0.0135	-0.0224	0.000949

	(1.293)	(-1.268)	(1.480)
Loss	0.0519***	0.00806	0.00331***
	(5.699)	(0.463)	(5.914)
TradingVolume	0.0185***	0.0582***	0.00101***
	(3.739)	(5.984)	(3.388)
CrossListed	0.0176	0.0508**	0.000719
	(1.595)	(2.067)	(1.078)
Big6Auditor	-0.0357***	-0.0452**	-0.00206***
	(-3.615)	(-2.447)	(-3.394)
EarningsSurprise	0.000139	0.000365*	7.04e-06
	(1.209)	(1.687)	(1.006)
Constant	0.167***	-0.344***	0.0155***
	(3.140)	(-4.298)	(6.292)
Observations	8,283	8,283	8,283
Adjusted R^2	0.362	0.226	0.383
Industry dummies	YES	YES	YES
Robust SE	YES	YES	YES

This table reports results from OLS regression of the effect of risk disclosure on investor risk perception during and after the Global Financial Crisis. We redo the analysis of Table 3 and include *DuringFinancialCrisis*, a dummy variable taking the value 1 for the financial year 2007 and 2008, 0 otherwise, and *AfterFinancialCrisis*, a dummy variable taking the value 1 for the financial years 2009–2017 and 0 otherwise. In model (1), the dependent variable is the annualised standard deviation of stock returns over 60 days after release of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of risk-related sentences in the annual report. In model (2), the dependent variable is the coefficient loading on the market return when regressing stock returns on the market return over 60 days after release of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of systematic risk-related sentences in the annual report. In model (3), the dependent variable is the standard deviation of the residuals from regression of stock returns on the market return over 60 days after release of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of idiosyncratic risk-related sentences in the annual report. Industry dummies are included. Continuous variables are winsorized at the 1st and 99th percentiles. T-statistics are reported in parentheses. Standard errors are heteroskedasticity-robust. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Specification (1) of Table 5.8 includes the two dummy variables and their respective interaction with *RiskDisclosure_total*. The interaction term *RiskDisclosure_total * DuringFinancialCrisis* is positive and significant, suggesting that the effect of risk disclosure on investor risk perception is stronger during the GFC. *AfterFinancialCrisis* does not affect the relation. Surprisingly, we find that the relationship between systematic risk disclosure and investors' systematic risk perception is affected neither at the time of the GFC nor in the years following it. One possible explanation is that, since systematic risk cannot be diversified away, it is always very relevant, regardless of the financial year. Information on idiosyncratic risks, that is, risks that can be diversified away, seem to be more relevant during the GFC. The interaction term *RiskDislcosure_idiosyncratic * DuringFinancialCrisis* is positive and significant, suggesting that the positive relation between idiosyncratic risk disclosure and investor perceived idiosyncratic risk

is enhanced. Thus, for total risk disclosure and idiosyncratic risk disclosure, we observe that the effect on investor risk perception is stronger during the GFC. No such effect can be observed for the years following the GFC.

5.5.2.2. Firm characteristics and external factors

Table 5.9 reports results for our subsample analysis, i.e. the effect of risk disclosure on investor risk perception for firms with a low vs. high numbers of analysts following, firms that have no foreign holdings compared to firms that do, and firms that file their annual report early vs. firms that file late.

Table 5.9: Effect of risk disclosure on investor risk perception
Additional analysis: Effect of analyst following, foreign holdings and filing speed

Panel A Low analyst following vs. high analyst following						
Dependent variable:	*SDReturns_after*		*Beta_after*		*SDResiduals_after*	
VARIABLES	(1) Low analyst following	(2) High analyst following	(3) Low analyst following	(4) High analyst following	(5) Low analyst following	(6) High analyst following
RiskDisclosure_total	0.0304**	0.00621				
	(1.964)	(0.544)				
RiskDisclosure_systematic			-0.0127	0.0572*		
			(-0.649)	(1.706)		
RiskDisclosure_idiosyncratic					0.00239***	0.000315
					(3.190)	(0.547)
Constant	0.233***	0.361***	-0.0288	0.411*	0.0161***	0.0214***
	(2.623)	(5.639)	(-0.235)	(1.925)	(3.459)	(6.718)
Control variables	YES	YES	YES	YES	YES	YES
Observations	2,438	1,216	2,438	1,216	2,438	1,216
Adjusted R^2	0.321	0.491	0.026	0.289	0.332	0.504
Year and industry dummies	YES	YES	YES	YES	YES	YES
Robust SE	YES	YES	YES	YES	YES	YES
Panel B No foreign holdings vs. foreign holdings						
Dependent variable:	*SDReturns_after*		*Beta_after*		*SDResiduals_after*	
VARIABLES	(1) No foreign holdings	(2) Foreign holdings	(3) No foreign holdings	(4) Foreign holdings	(5) No foreign holdings	(6) Foreign holdings
RiskDisclosure_total	0.0324***	0.0489***				
	(3.124)	(3.841)				

RiskDisclosure_systematic			0.0392**	0.0520***		
			(2.554)	(2.831)		
RiskDisclosure_idiosyncratic					0.00193***	0.00212***
					(3.669)	(3.256)
Constant	0.109**	0.117**	-0.338***	-0.374***	0.0105***	0.0141***
	(2.256)	(2.174)	(-3.692)	(-3.981)	(4.378)	(5.380)
Control variables	YES	YES	YES	YES	YES	YES
Observations	4,688	3,595	4,688	3,595	4,688	3,595
Adjusted R^2	0.364	0.354	0.219	0.237	0.385	0.375
Year and industry dummies	YES	YES	YES	YES	YES	YES
Robust SE	YES	YES	YES	YES	YES	YES

Panel C Early filers vs. late filers

Dependent variable:	*SDReturns_after*		*Beta_after*		*SDResiduals_after*	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	early filers	late filers	early filers	late filers	early filers	late filers
RiskDisclosure_total	0.0378**	0.0608***				
	(2.407)	(3.125)				
RiskDisclosure_systematic			0.0675***	0.0257		
			(2.675)	(0.994)		
RiskDisclosure_idiosyncratic					0.00291***	0.00277***
					(3.686)	(2.741)
Constant	0.0682	0.0507	-0.448***	-0.265	0.00789*	0.0123***
	(0.873)	(0.536)	(-3.557)	(-1.520)	(1.862)	(2.621)
Control variables	YES	YES	YES	YES	YES	YES
Observations	1,696	1,633	1,696	1,633	1,696	1,633
Adjusted R^2	0.341	0.334	0.290	0.188	0.363	0.346
Year and industry dummies	YES	YES	YES	YES	YES	YES
Robust SE	YES	YES	YES	YES	YES	YES

This table reports results for the effect of risk disclosure on investor risk perception, taking into account the number of analysts following the firm, the percentage of foreign holdings and the filing speed of the annual report. Panel A reports results for firms within the first quintile of the number of analysts following the firm (low analyst following) and firms that fall within the fifth quintile of the number of analysts following (high analyst following). Panel B reports results for firms that have no foreign holdings (no foreign holdings) and firms which are held (at least 5%) by institutions outside the U.K. (foreign holdings). Panel C reports results for early and late filers. Filing speed is measured as the time between the end of the financial year and the filing date of the annual report. Early filers fall within the first quintile of filing speed and late filers within the fifth quintile. In models (1) and (2), the dependent variable is annualised standard deviation of stock returns over 60 days after release of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of risk-related sentences in the annual report. In models (3) and (4), the dependent variable is the coefficient loading on the market return when regressing stock returns on the market return over 60 days after release of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of systematic risk-related sentences in the annual report. In models (5) and (6), the dependent variable is the standard deviation of the residuals from regression of stock returns on the market return over 60 days after release of the annual report, starting 3 days after the filing date. The independent variable of interest is the natural logarithm of the number of idiosyncratic risk-related sentences in the annual report. Control variables, year dummies and industry dummies are included. Continuous variables are winsorized at the 1st and 99th percentiles. T-statistics are reported in parentheses. Standard errors are heteroskedasticity-robust. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Miikhinen (2013) finds that risk disclosure is more useful for firms being followed by a low number of analysts, suggesting that investors know little about the risk profile of sparsely followed firms, and thus are more dependent on analyst reports. Panel A of Table 5.9 reports results for low (high) analyst coverage, i.e. firms that fall within the first (fifth) quintile of the number of analysts following the firm. For total risk disclosure and idiosyncratic risk disclosure, we confirm the results of Miikhinen (2013); risk disclosure is more relevant for firms with low analyst coverage. For systematic risk disclosure, we find the opposite; systematic risk disclosure of firms with high analyst coverage is relevant, while it is not for firms with low analyst coverage. This is in line with the effect of firm size on investor risk perception. Larger firms tend to have greater analyst following (Elshandidy & Neri, 2015), and thus information on market-wide risk factors for firms with high analyst coverage is more relevant, since the potential negative impact of systematic risks for large firms is greater than for small firms.

Previous studies show that the ownership structure of a firm influences its risk disclosure behaviour (Abraham & Cox, 2007; Ntim et al., 2013). Panel B of Table 5.9 reports results for firms with and without foreign ownership. For all three risk disclosure variables, *RiskDisclosure_total*, *RiskDislcosure_systematic* and *RiskDisclosure_idiosyncratic*, the coefficient is higher for firms with foreign holdings than for firms without foreign holdings. Risk disclosure for firms with foreign ownership is more relevant, and these firms are perceived to be riskier.

Late filing of the annual report could indicate a significant problem (Brown & Tucker, 2011; Choudhary, Merkley & Schloetzer 2009). Such firms might thus be perceived as more risky. Contrarily, information on risk factor exposure could be more relevant for early filers as investors read about risks for the first time. Specifications (1), (3) and (5) of Panel C, Table 5.9, show results for firms that file early, meaning that they fall within the first quintile of filing speed, while specifications (2), (4) and (5) show results for firms that fall within the fifth quintile. Filing speed is the time between the end of the financial year and the filing date. The effect of total risk disclosure (specifications (1) and (2)) on investor risk perception is stronger for later filers than for early filers. This supports the argument that late filing is perceived as a bad signal and may indicate a significant problem. Specifications (3) and (4) show results for the effect of systematic risk disclosure on investor perception of systematic risk for early and late filers. For early filers, the coefficient on *RiskDisclosure_systematic* is positive and significant, while it is not significant

for late filers. Thus, information on exposure to risk factors that are market-wide is not relevant for late filers. By the time late filers have filed, investors have read about market or industry-wide risk factors in the annual reports of other firms. The coefficient on *RiskDisclosure_idiosyncratic* is higher for early filers than for late filers. This suggests that idiosyncratic risk disclosure is more relevant if firms report in a more timely manner. If the time between the financial year end and the filing date expands, the probability increases that information on firm-specific risk factors reaches investors through other channels.

5.6. Conclusion

This study analyses the relevance of risk disclosure in annual reports of U.K. listed companies. We find that overall risk disclosure, systematic risk disclosure, i.e. information on market-wide risk factors, and idiosyncratic, i.e. firm-specific, risk disclosure are relevant to investors and increase perceived total firm risk, systematic firm risk and idiosyncratic firm risk, respectively. If risk disclosures are difficult to read, firms are perceived to be riskier. If systematic risk disclosure is similar to that of peer companies, the relevance of the disclosure is affected. If such risk disclosures are similar, the positive effect of systematic risk disclosure on perceived systematic risk decreases. Investor expectations about a firm's exposure to systematic risks are confirmed, and thus the positive effect of risk disclosure on investor risk perception is reduced. This contrasts with the effect of the readability of systematic risk disclosure. If disclosures are difficult to read, perceived systematic risk increases.

Our results further show that during the GFC, the relevance of total and idiosyncratic risk disclosure was enhanced and firms were perceived to be riskier. We further analyse firm characteristics and external factors and find that total risk disclosure and idiosyncratic risk disclosure are relevant only for firms with low analyst coverage. This suggests that investors know little about the risk profile of these firms and they thus react more strongly. For systematic risk disclosure, the opposite is the case. The ownership structure of firms influences the relation between risk disclosure and investor risk perception. Firms with foreign holdings are perceived to be riskier. This holds for total, systematic and idiosyncratic risk disclosure. Annual report filing speed also affects our results. If firms file early, total risk disclosure is less relevant. For systematic and idiosyncratic risk disclosure, the opposite is true; firms are perceived to be riskier if they file early. This is mainly because the information is more relevant the first time investors read it. As

risk disclosure, especially systematic risk disclosure, repeats itself among peer companies, the information becomes less relevant for late filers.

Overall, our results show that risk disclosure is not boilerplate. It is relevant to investors and thus satisfies one of the fundamental qualitative characteristics of financial information stipulated by the IASB. Further, the linguistic features of firm risk information play an important role. Firms should put more emphasis on reporting in a clear and understandable way and respect the enhanced qualitative characteristics of financial information called for by the IASB.

5.7. References

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5.8. Appendix Variable Definitions

Variable name	Definition	Source
Dependent variables		
SDReturns_after	Annualised standard deviation of daily stock returns over 60 days after publication of the annual report, starting 3 days after the filing date.	Datastream Expression
Beta_after	Coefficient loading on the market return when regressing daily stock returns on the daily market return over 60 days after publication of the annual report, starting 3 days after the filing date.	Datastream item REGB
SDResiduals_after	Standard deviation of residuals from the regression of daily stock returns on the daily market return over 60 days after publication of the annual report, starting 3 days after the filing date.	Standard deviation of Datastream item REGR
Independent variables		
RiskDisclosure_total	Number of sentences in the annual report containing at least one risk key word from the list in Elshandidy et al. (2013). We refer to the ensemble of risk-related sentences as the risk corpus (corpus containing only risk-related sentences, i.e. risk factor description). In our regression analysis, we include the natural logarithm of this variable.	Computer-aided textual analysis based on annual reports
RiskDisclosure_systematic	Number of systematic risk-related sentences within the risk corpus. First, based on the word list in Elshandidy et al. (2013), we define risk-related sentences. Then, in a second step, we define the number of systematic risk-related sentences based on the key word list in Campbell et al. (2014). Thus, we apply the systematic key word list to the risk corpus. These sentences then form the systematic risk corpus. In our regression analysis, we include the natural logarithm of this variable.	Computer-aided textual analysis based on annual reports
RiskDisclosure_idiosyncratic	Number of idiosyncratic risk-related sentences within the risk corpus. First, based on the word list in Elshandidy et al. (2013), we define risk-related sentences. Then, in a second step, we define the number of idiosyncratic risk-related sentences based on the key word list in Campbell et al. (2014). Thus, we apply the idiosyncratic key word list to the risk corpus.	Computer-aided textual analysis based on annual reports

	These sentences then form the idiosyncratic risk corpus. In our regression analysis, we include the natural logarithm of this variable.	
Fog_total	Fog index of risk-related sentences (i.e. the risk corpus). The higher the Fog index, the less readable are the risk-related sentences.	Computer-aided textual analysis based on annual reports
Fog_syst	Fog index of systematic risk-related sentences (i.e. the systematic risk corpus). The higher the Fog index, the less readable are the systematic risk-related sentences.	Computer-aided textual analysis based on annual reports
Fog_idio	Fog index of idiosyncratic risk-related sentences (i.e. the idiosyncratic risk corpus). The higher the Fog index, the less readable are the idiosyncratic risk-related sentences.	Computer-aided textual analysis based on annual reports
ComparabilityPeers_total	Median value of cosine similarities between the risk-related sentences of a firm and the risk-related sentences of all other firms operating in the same industry for a given year. Similarity scores range between 0 and 1, with 1 indicating that the vector of words for two texts align and thus are very similar.	Computer-aided textual analysis based on annual reports
ComparabilityPeers_syst	Median value of cosine similarities between the systematic risk-related sentences of a firm and the systematic risk-related sentences of all other firms operating in the same industry for a given year. Similarity scores range between 0 and 1, with 1 indicating that the vector of words for two texts align and thus are very similar.	Computer-aided textual analysis based on annual reports
ComparabilityPeers_idio	Median value of cosine similarities between the idiosyncratic risk-related sentences of a firm and the idiosyncratic risk-related sentences of all other firms operating in the same industry for a given year. Similarity scores range between 0 and 1, with 1 indicating that the vector of words for two texts align and thus are very similar.	Computer-aided textual analysis based on annual reports
ComparabilityYears_total	Cosine similarities between risk-related sentences of a firm in year *t* and risk-related sentences of the same firm in year *t*-1. It compares current-year risk-related sentences to previous-year risk-related sentences for a given firm. Similarity scores range between 0 and 1, with 1 indicating that the vector of words for two texts align and thus are very similar.	Computer-aided textual analysis based on annual reports

ComparabilityYears_syst	Cosine similarities between systematic risk-related sentences of a firm in year *t* and systematic risk-related sentences of the same firm in year *t*-1. It compares current-year systematic risk-related sentences to previous-year systematic risk-related sentences for a given firm. Similarity scores range between 0 and 1, with 1 indicating that the vector of words for two texts align and thus are very similar.	Computer-aided textual analysis based on annual reports
ComparabilityYears_idio	Cosine similarities between idiosyncratic risk-related sentences of a firm in year *t* and idiosyncratic risk-related sentences of the same firm in year *t*-1. It compares current-year idiosyncratic risk-related sentences to previous-year idiosyncratic risk-related sentences for a given firm. Similarity scores range between 0 and 1, with 1 indicating that the vector of words for two texts align and thus are very similar.	Computer-aided textual analysis based on annual reports
Control variables		
SDReturns_before	Annualised standard deviation of daily stock returns over 60 days before publication of the annual report, starting 3 days before the filing date.	Datastream expression
Beta_before	Coefficient loading on the market return when regressing daily stock returns on daily market return over 60 days before publication of the annual report, starting 3 days before the filing date.	Datastream expression
SDResiduals_before	Standard deviation of the residuals from regression of daily stock returns on the daily market return over 60 days before publication of the annual report, starting 3 days before the filing date.	Datastream expression
FirmSize	Natural logarithm of firm market value.	Datastream item MV
BooktoMarket	Book-to-market ratio of the firm.	Datastream item MTBV
Profitability	Return on assets of a firm.	Worldscope item WC08326
Leverage	Sum of short-term debt and long current debt, divided by firm common equity.	Worldscope items WC03051 and WC03501
Loss	Dummy variable taking the value 1 if net income is below zero, 0 otherwise.	Worldscope item WC01551
TradingVolume	Daily trading volume divided by number of common shares outstanding.	Datastream item VO and

		Worldscope item WC05301
CrossListed	Dummy variable taking the value 1 if the firm has American Depositary Receipts (ADR) traded on a U.S. exchange, 0 otherwise.	Worldscope item WC11496
Big6Auditor	Dummy variable taking the value 1 if the firm is audited by a Big 6 audit firm (i.e. PriceWaterhouseCoopers, KPMG, Ernst & Young, Deloitte, BDO and Grant Thornton), 0 otherwise.	Worldscope item WC07800
EarningsSurprise	Difference between reported earnings per share and mean forecast earnings per share.	Datastream item EPS and IBES item EPS1MN