Textual Risk Disclosures

and Investors' Risk Perceptions

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Abstract
We examine the association between changes in companies' textual risk disclosures in 10-K filings and changes in stock market and analyst activity around the filings. We find that annual increases in risk disclosures are associated with increased stock return volatility and trading volume around and after the filings. Increases in risk disclosures are also associated with more dispersed earnings forecasts and forecast revisions after the filings. In contrast to prior literature documenting resolved uncertainties in response to various types of company disclosures, our findings suggest that textual risk disclosures increase investors' risk perceptions. However, the results are less pronounced for firm-level disclosures that deviate from those of other companies in the same industry and year and for risk disclosures emphasizing negative outcomes. These results lend support for critics' arguments that firm-level risk disclosures and disclosures that emphasize negative outcomes are more likely to be boilerplate.

JEL Classification: D8, G24, G12, M4.

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"To know what we know, and know what we do not know, is wisdom" Confucius

1 Introduction

A long-standing criticism of financial reporting is the lack of useful disclosures about company risks and uncertainties (AICPA 1987; Schrand and Elliott 1998). This criticism has become more important amidst large market-wide fluctuations in the last decade (Kaplan 2011). Regulators have traditionally responded to market-wide fluctuations by encouraging corporations to make more meaningful risk disclosures (Jorgensen and Kirschenheiter 2003). Despite the increasing regulatory oversight, critics argue that companies do not make useful disclosures about corporate risks and uncertainties.

In this study, we investigate the informativeness of textual risk disclosures in company annual reports filed with the SEC between years 1994 and 2007. Textual risk disclosures, which have grown in length and content during the sample period, present users with companies' assessments about future contingencies as well as a range of exposures to market factors. Textual risk disclosures differ from other corporate disclosures in that they guide users about the *range* of future performance rather than the *level* of future performance. This distinction is reflected in how we test the informativeness of textual risk disclosures. We hypothesize that informative risk disclosures will change users' risk perceptions, i.e., the range of users' predictions of future performance as well as users' confidence in their predictions.

We test three competing arguments about whether and how risk disclosures affect users' risk perceptions. The first argument is that risk disclosures are by and large boilerplate (hereafter, the *null argument*). The second argument is that risk disclosures reveal previously unknown risk factors and contingencies, thereby increasing users' risk perceptions (hereafter, the *divergence argument*). The third argument is that risk disclosures resolve a company's known risk factors and contingencies, thereby reducing users' risk perceptions (hereafter, the *convergence argument*). In an effort to improve the power of our tests, we employ a changes analysis because we expect companies to repeat a significant portion of their risk disclosures over years as internal risk assessments may not change dramatically over time. We investigate how annual changes in risk disclosures change users' risk perceptions around the filing dates, as measured by stock return volatility, trading volume, and analysts' forecasts.

Our tests support the divergence argument. The annual increase in the number of risk sentences in a company's 10-K filing is associated with higher return volatility—particularly in negative stock returns—and a higher trading volume during the first two months after the filing relative to the last two months before the filing; a higher three-day trading volume around the filing; a higher dispersion of analysts' forecasts after the filing; and more volatile forecast revisions around the filing. Our results are robust to controls for other information in the 10-K filing, changes in the complexity of the annual report, changes in size, performance, ownership, managerial earnings forecasts, and changes in market return and volatility around the filings. The effect of risk disclosures is economically significant relative to the effect of the total information content of the 10-K filing. Our finding of higher dispersion in forecasts and forecast revisions differs from literature that generally documents reduced forecast dispersions after corporate disclosures (Lang and Lundholm 1996; Nichols and Wieland 2009). We attribute these differences to risk disclosures informing the market about contingencies and risk factors that were previously unknown to investors.

An important question unanswered by the above evidence and prior research is whether idiosyncratic risk disclosures are more informative than industry-wide risk disclosures. To provide insights into this question, we divide our key variable of interest, the change in a company’s number of risk sentences, into two components: i) median change in the number of risk sentences of other companies in the same industry and fiscal year, and ii) the deviation from (i). In general, we observe stronger relations between industry-level risk disclosures and changes in users’ risk perceptions, suggesting that firm-specific disclosures are less informative than industry-level disclosures.

In addition, we examine whether risk disclosures that emphasize negative contingencies have an incremental effect on users’ risk perceptions. Because forewarning about negative outcomes is an important purpose of risk disclosures, risk disclosures emphasizing negative outcomes should have a stronger effect than other risk disclosures. However, (the absence of) risk disclosures are criticized more after realized negative outcomes, suggesting that managers emphasize negative contingencies to avoid ex-post litigation for any conceivable bad news. We find that risk disclosures emphasizing negative contingencies change users’ risk perceptions less strongly than other risk disclosures do.

Our study contributes to the risk disclosure literature. Prior literature examines the effect of SFAS 119 derivative disclosures and Financial Reporting Release (FRR) No. 48, which requires companies to disclose exposures of financial assets and liabilities to market factors such as interest rates, exchange rates, and commodity prices (Rajgopal 1999; Linsmeier et al. 2002; Jorion 2002; Wong 2000). While this literature generally finds that FRR No. 48 and SFAS 119 disclosures are informative, it is unclear from these studies whether and how textual risk disclosures are informative for several reasons. First, FRR No. 48 and SFAS 119 mandate companies to disclose specific quantitative information about the known exposures to market factors. Therefore, this prior evidence is based on a setting where investors’ risk perceptions are bound to converge with additional disclosures. Second, textual risk disclosures cover a much broader spectrum of risk factors, such as operational and legal risks, which the prior literature does not examine. These types of risk are also more difficult to assess than SFAS 119 and FRR No. 48 disclosures which deceases the generalizability of the prior literature's findings to the broader risk disclosure setting. Third, the empirical analyses in prior literature predate the two major economic crises in the recent decade (i.e., 2000 and 2008), raising additional concerns about generalizing the literature's conclusions to more current periods.

Our study also complements the emerging textual analysis literature. In a contemporary paper that expands the scope of risk disclosures, Li (2008a) uses a similar method with ours and finds that companies signal bad future earnings through textual risk disclosures and that stocks of these companies perform poorly after the filings, consistent with investors underreacting (or not reacting) to these signals. We complement Li (2008a) by documenting that users in general react to textual risk disclosures. In another contemporary paper, Campbell et al. (2011) find that the length of Section 1A in 10-K filings, which are mandated after 2005 as an outlet for company's risk factors, reduces information asymmetry (proxied by bid-ask spreads) but increases investors' risk perceptions (proxied by beta and stock return volatility). There are significant differences in the sample and empirical choices between our paper and Campbell et al. (2011), preventing a direct comparison of the findings. Yet, both papers converge that risk disclosures are informative. Lehavy et al. (2010) find that readability of 10-K filings affects analyst forecast dispersion, accuracy, and effort. Similarly, You and Zhang (2009) find that investors underreact to longer 10-K filings, pointing to the time and effort spent on interpreting the filings. We find that the risk disclosures have an incremental effect on analyst forecast dispersion and uncertainty over the effect of the above readability and complexity measures.

The remainder of the paper is organized as follows. Section 2 provides hypothesis development in light of previous theoretical and empirical research. Section 3 describes the sample selection and research design. Section 4 presents empirical results. Section 5 concludes.

2 Hypothesis Development

A large body of research finds that different forward-looking disclosures, such as managerial forecasts, press releases, and conference calls, resolve corporate uncertainties (Beyer et al. 2010; Mohanram and Sunder 2006; Clement et al. 2003).[1] Though inherently forward-looking, risk disclosures differ from forward-looking disclosures in that they explain but do not necessarily resolve corporate uncertainties. That is, rather than informing users about a point forecast of performance that users can converge their forecasts around, risk disclosures provide information about the second moment of expected performance. Hence, risk disclosures have the potential to decrease or increase users' risk perceptions (Cready 2007; Kim and Verrechia 1994).

2.1 Regulatory environment for corporate risk reporting

The primary objective of financial reporting is to provide useful information to assess the amount, timing, and uncertainty of future net cash inflows to the entity (FASB 2010). Several standards require or encourage companies to disclose corporate uncertainties. SFAS No. 106 requires disclosures about potential changes in postretirement benefit plan costs (FASB 1990). SFAS No. 133, which superseded SFAS No. 119 and was later amended by SFAS 155, encourages companies to disclose quantitative information about market risks of derivative instruments and hedging activities (FASB 1998). SFAS No. 140 requires that companies with

[1] There is limited counter-evidence suggesting that not all non-risk disclosures resolve uncertainties. Rogers et al. (2009) document higher implied volatilities derived from exchange-traded options around managerial forecasts (especially around irregular managerial forecasts and forecasts that convey bad news).

securitized financial assets to disclose information about key assumptions made in determining fair values of retained interests (FASB 2000). The Private Securities Litigation Reform Act of 1995 establishes a safe harbor from liability in private lawsuits for companies making meaningful risk statements that accompany forward-looking statements.

Corporate risk reporting receives particular regulatory attention after market downturns and volatilities. For instance, corporate losses from financial transactions in the early 1990s prompted calls for expanded disclosures on financial instruments (Linsmeier and Pearson 1997). In January 1997, the SEC issued FRR No. 48 requiring firms to provide information about their market risk-exposures on their trading and non-trading instruments, such as those related to stock prices, interest rates, exchange rates, and commodity prices (SEC 1997).[2] Similarly, after stock market declines from 2000 to 2002, the SEC mandated that companies discuss risk factors in the first pages (Section 1A) of 10-K filings.[3] In its interpretive guidance, the SEC states "…in identifying, discussing, and analyzing known material trends and uncertainties, companies are expected to consider all relevant information, even if that information is not required to be disclosed" (SEC 2003). The economic crisis of 2008 resulted in more regulatory oversight on risk disclosures. The SEC has intensified review of risk disclosures in corporate filings and used comment letters to require more risk information from specific companies and industries (Johnson 2010). The Dodd-Frank Act of 2010 creates regulatory agencies that are mandated to search for unforeseen risks in the financial system (Financial Stability Oversight Council and Office of Financial Research), and grants the SEC and the Federal Reserve more authority to improve transparency in the financial system and corporate governance.

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[2] FRR No. 48 mandates these disclosures to be made as Item 7A as described in Item 305 of Regulation S-K introduced under the Securities Exchange Act of 1934, which had encouraged registrants to provide market risk disclosures.

[3] These factors have to be provided under the caption "Risk Factors" (as Item 1A in the 10-K filing) as described in Item 503(c) of Regulation S-K introduced under the Securities Exchange Act of 1934.

2.2. Challenges in reporting corporate risk

Financial authorities require companies to make ‘meaningful’ risk disclosures. This is evidenced in SEC’s intensified requests for clarification from companies believed to have used boilerplate statements and courts’ ruling that fixed and cryptic cautionary language does not satisfy the safe harbor provision of the Private Securities Litigation Reform Act (Nelson and Pritchard 2007). Despite the regulatory environment, users allege that companies do not provide useful risk-related information. For instance, unless accompanied by specific details, a statement like “*Our company may not be able to implement its growth strategy*” may help companies comply with regulations, but is likely not informative to users in assessing corporate risks and uncertainties. Several factors contribute to this alleged deficiency. First, corporate risk assessments are often regarded as negative information (Li 2008a), which managers tend to withhold because of career concerns (Kothari et al. 2009). Second risk assessments include proprietary information, which companies tend to withhold to reduce competition (Dye 1985). Finally, given their ever-changing and prospective nature, a company’s risk exposures are hard to perceive and measure. Kaplan (2011) states “How can we quantify risk or develop risk indicators for an event that has not yet occurred and, we hope, may never occur?” The general lack of corporate warnings before the near-collapse of the financial system in 2008 is recent evidence of unrecognized or mismeasured risks.

2.3. Reporting known and unknown risks

The psychology and economics literature have long distinguished between known and unknown risks. Knight (1921) defines ‘risk’ as decision situations with available probabilities to guide choice, and ‘uncertainty’ as decision situations in which information is too imprecise to be summarized by probabilities. Similarly, Slovic et al. (1980) define known risk as probabilities of future outcomes that can be perceived by individuals, and unknown risk as unobservable or uncontrollable future outcomes that adversely affect individuals' judgments. Investors' distaste for unknown risks, also known as ambiguity aversion or information risk, affect asset prices over and above the effect of traditional risk factors (Barry and Brown 1985; Epstein and Schneider 2008; Caskey 2009).[4] In an experimental setting, Koonce et al. (2005) find that investors' risk assessments are affected by unknown and dread, the two behavioral factors of Slovic (1987), besides conventional decision variables such as probabilities and outcomes.

Prior research on risk reporting does not distinguish between known and unknown risks, and documents that mandated disclosures provide useful information about market risk factors (Hodder et al. 2001).[5] Rajgopal (1999) finds that oil and gas firms' disclosures about market exposures are associated with stock return sensitivities to oil and gas prices. Linsmeier et al. (2002) find that trading volume sensitivity to changes in market risk exposures declines. Jorion (2002) finds that banks' Value at Risk (VaR) disclosures predict trading revenues. In contrast, Wong (2000) finds only weak evidence that derivative disclosures help predict currency exposures. These studies are limited to the disclosures of known market risk factors and generally find that investors' risk perceptions decrease after these disclosures.

2.4. Information content of risk disclosures

The quantifiable market-wide risk factors comprise a small portion of contingencies and risk factors, which include those related to competition, suppliers, employees, and customers, financing, foreign operations, regulations, litigation, governance, and environment. The severity

[4] A related strand of literature examines how information precision and information asymmetry affects the cost of capital (Diamond and Verrecchia 1991; Botosan 1997; Francis et al. 2004; Easley and O'Hara 2004; Lambert, Leuz, and Verrecchia 2007; Bhattacharya et al. 2009).

[5] The theoretical literature on risk disclosures focuses on companies' cost of capital. Jorgensen and Kirschenheiter (2003) propose a partial disclosure equilibrium, in which managers voluntarily disclose (not disclose) if their firm has low (high) variance of future cash flows; and the disclosing firm has a lower risk premium ex post.

of this disclosure gap is only addressed by the recent regulatory efforts that mandate that companies discuss their quantitative *and* qualitative assessments about risks and uncertainties. As such, the quality of risk disclosures remains largely voluntary despite the efforts of regulators, and the informativeness of such disclosures, to our knowledge, is largely unknown.

Two recent papers address this question from different angles. First, Li (2008a) documents that an increase in risk sentiment in annual reports (as captured by count of words 'risk' and 'uncertainty') is associated with poor future stock returns, suggesting that investors underreact to the risk sentiment of annual reports. Second, Campbell et al. (2011) find that the length of Section 1A's of the 10-K filings (in which companies identify their risk factors after December 2005) is associated with low bid-ask spreads (to proxy for information asymmetry) and high beta and stock return volatility (to proxy for investors' assessments of fundamental risk) in the following year. We complement this evidence with a particular emphasis on how users' risk perceptions change in response to changes in textual risk disclosures.

Our study also contributes to the more general literature studying textual disclosure in annual reports. Li (2008b) find that the readability of annual reports is associated with earnings persistence and Lehavy et al. (2010) find that the readability of annual reports affects investors' decisions. Other literature examines the effect of tone in annual reports (Kothari et al. 2009; Feldman et al. 2010; Davis and Tama-Sweet 2011). More closely related to our study, Nelson and Pritchard (2007) find that firms increase their cautionary language in annual reports in response to litigation risk. Li (2010) finds that that tone in forward-looking statements in the MD&A section is associated with future earnings where statements related to risk and uncertainty are a component of tone. We extend this literature by examining a specific type of disclosure in annual reports that is distinct from the notion of tone. In addition, we analyze below in separate analysis the effect of negative tone in risk disclosures.

2.5. Measuring risk disclosures

We develop a UNIX Perl code that, in sequence, (1) downloads 10-K filings from the SEC *Edgar* database, (2) extracts textual risk disclosures from the 10-K filings, and (3) analyzes the content of these disclosures. For brevity, we describe only key aspects of our methodology in this section. Appendix A describes our code in detail.

The Perl code parses the annual report into sentences after excluding Sections 3 and 4, which include appendices about executive biographies, third-party transactions, and legal documents. Next, the code tags a sentence as risk-related if the sentence includes at least one risk-related keyword. The keywords are as follows (where a '*' implies that suffixes are allowed): can, cannot, could, may, might, risk*, uncertain*, likely to, subject to, potential*, vary*, varies, depend*, expos*, fluctuat*, possibl*, susceptible, affect, influenc*, and hedg*. The keyword list is developed based on our reading of 100 randomly selected annual reports. We then define the level of risk disclosure, $Risk\ Disclosure_{i,t}$, as the number of sentences with at least one of the keywords.[6]

2.6. Predictions

Given that many risk exposures will change little over time, companies are likely to repeat their risk assessments over their consecutive annual filings. We therefore adopt a changes methodology to understand how users react to companies new risk disclosures. In order to

[6] We acknowledge that this algorithm does not perfectly measure the intensity of risk disclosures in annual reports. For instance, our algorithm defines as single sentences tables, some of which present extensive information about how projected performance can vary with respect to various factors. Furthermore, we do not differentiate between audited risk statements that are in the footnotes and unaudited risk statements that are elsewhere in the annual report. However, the changes methodology of our tests should prevent such measurement errors affecting our conclusions. Further, our out-of-sample validation tests (untabulated) show that our routine is well-specified and powerful.

capture new risk disclosures in 10-K filings, our research design uses Δ*Risk Disclosure*$_{i,t}$, defined as the difference between *Risk Disclosure*$_{i,t}$ and *Risk Disclosure*$_{i,t-1}$.[7] We do not scale this variable but instead include in our model the change in number of non-risk sentences in 10-K filings to control for overall increases in the size and complexity of the annual report. We examine how Δ*Risk Disclosure*$_{i,t}$ changes the range of investors' and analysts' predictions as well as their confidence levels in their predictions using changes in the following variables around the filings: volatility of daily stock returns, trading volume, volatility of outstanding forecasts, volatility of individual forecast revisions, and divergence in individual forecast revisions.

Given the length of the 10-K filings, we expect that investors cannot promptly update their predictions. This is consistent with You and Zhang's (2009) finding that investors underreact to 10-K filings especially when the filings are complex. We keep the testing period long enough (two months) to allow for investors and analysts to interpret the reported risk exposures and react based on their interpretations, but short enough to prevent the effect of confounding events, such as the disclosure of other information about corporate risk.[8]

2.6.1. Stock return volatility

Morck et al. (2000) argue that increased firm-level return volatility indicates more detailed firm-specific information being incorporated into stock prices.[9] If risk disclosures introduce unknown contingencies and risk factors, then users will diverge in their predictions and users' confidence level in their predictions will decrease (divergence argument). Stock return

[7] Alternative methods to measure changes in textual risk disclosures involve examining the rate of change in the frequency of specific words used within text or frequency of word groups within a sentence (Brown and Tucker 2011; Nelson and Pritchard 2007). We choose changes in the number of risk disclosures as a proxy for changes in risk disclosures based on its empirical simplicity and the argument that a sentence is the smallest integral unit of text that conveys an idea or message (Ivers 1991).

[8] The empirical analysis is constrained by the possibility that, over long windows, there will be other news that may correlate with risk disclosures. Therefore, the causality interpretation of the results is potentially confounded, but—we argue—this is less likely with our study than for studies investigating changes in longer horizons such as years.

[9] There are also arguments that firm-level stock return volatility is associated with noise and less information about the company (Roll 1988), however this view seems to have lost support in recent years (Liu and Wysocki 2007).

volatility is a prominent proxy for diverging investor opinions in the finance literature (Shalen 1993; Garfinkel 2009). We therefore predict higher daily stock return volatility during the first two months after the filings than the last two months before the filings, reflecting the increased range and reduced confidence levels in investors' predictions of future performance. If on the other hand, risk disclosures resolve known contingencies and risk factors, then users will converge in their predictions and increase their confidence level (convergence argument). We therefore predict lower post-filing stock return volatility. We test the above predictions using the change in the volatility of stock returns from the 60 trading-day period before to the 60 trading-day period after the 10-K filing, Δσ(*Return*).

Given that return volatility is a symmetric risk measure and that risk disclosures are criticized for lack of information about negative eventualities, our second test focuses on the volatility of negative stock returns. If risk disclosures increase (decrease) users' risk perceptions, then the effect on downside risk will increase (decrease) more relative to the effect of upside risk, and therefore, daily negative stock returns will be more (less) volatile than daily positive stock returns. We measure this prediction using the change in the ratio of volatility of negative stock returns to volatility of positive stock returns from the 60 trading-day period before to the 60 trading-day period after the 10-K filing, Δ(σ(*Neg Return*)/σ(*Pos Return*)) (McAnally et al. 2011). σ(*Neg Return*) (σ(*Pos Return*)) is the standard deviation of trading days with negative (positive) returns, where days with positive (negative) returns are valued at zero.

2.6.2. Trading volume

Garfinkel (2009) shows that unexplained trading volume is the most reliable proxy for opinion divergence. Trading volume around earnings announcements reflects individual investors' differential belief revisions (Kim and Verrecchia 1991; Karpoff 1986).[10] Bamber et al. (1999) show that trading volume around earnings announcements increases with measures of differential interpretations. If the range of investors' predictions increases (decreases) because of risk disclosures in 10-K filings, there will be greater (lesser) differential belief revisions and thus increased (decreased) trading volume. Accordingly, we examine the short-window trading volume around the 10-K filings. We define *Log*(*Filing Volume*) as the logarithm of average trading volume divided by outstanding shares (+0.000255 to avoid negative values) in the three-day window around the 10-K filing (Cready and Hurtt 2002).

In addition, the divergence (convergence) argument predicts that investors trade more (less) after the filings relative to before the filings in response to their higher (lower) confidence levels of their predictions. Higher (lower) confidence levels make it more (less) likely investors change their expectations of firm value based on the arrival of new information. We define Δ*Log*(*Volume*) as the change in a company's logarithm of the average trading volume divided by outstanding shares from the last two-month period before the 10-K filing to the first two-month period after the filing.

2.6.3. Analysts' differential interpretations

Dispersion in analyst forecasts increases with uncertainty (Barron et al. 1998). If risk disclosures increase users' risk perceptions–especially if investors do not know about the reported risk factors–then analysts will diverge in their beliefs. This expectation is in line with Barron et al. (2002), who document that commonality of information among active analysts decreases around earnings announcements, and with Kim and Verrecchia (1991), who argue that analysts generate idiosyncratic information around earnings announcements.

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[10] Differential belief revision around disclosures can arise from either: (1) differential interpretations of the disclosures, or (2) differences in the precision of investors' pre-disclosure information.

On the other hand, risk disclosures can update a company's assessments on risk factors, on which analysts can converge their beliefs–especially if the risk factors are previously known to investors. The literature generally suggests that corporate disclosures reduce assessed variance of future cash flows and thus reduce dispersion of analyst forecasts (Lambert et al. 2007). Distinct from the above arguments, the null argument predicts that analysts will not revise their forecasts differently if they assess risk disclosures to be uninformative, rendering the dispersion in outstanding forecasts and divergence in forecast revisions unchanged.

We use three variables of analysts' differential interpretations. Δ*Forecast Dispersion* is an indicator variable that is equal to one if the standard deviation of one-year-ahead earnings forecasts issued during the first two months after the 10-K filings is greater than that of outstanding forecasts issued during the last two months before the filings. We use an indicator variable in order to reduce the effect of random variation in analyst forecasts. σ(*Forecast Revision*) is calculated as the standard deviation of individual analysts' forecasts revisions, defined as forecasts issued during the first two months after the filings net of those issued during the last two months before the filings. *KP Forecast Divergence*, which is developed by Kandel and Pearson (1995), is defined as the proportion of all pairs of analysts' forecast revisions that i) move in opposite direction, and ii) either flip or diverge around the 10-K filing. A pair of forecasts flips when one analyst's forecast is higher than the other analyst's forecast in the pre-filing period but lower in the post-filing period. A pair of analysts' forecasts diverges when the difference between the two forecasts increases from the pre-filing period to the post-filing period. We require at least five analysts to compute these variables.[11]

[11] A meaningful number of analysts are needed to compute the forecast dispersion and revision variables. The results are similar if the number of analysts used is higher than five. The results are similar if the number of analysts used is lower than five, except for tests involving Δ*Forecast Dispersion*.

2.6.4. Firm- versus industry-level disclosures

Risk disclosures are primarily criticized for lack of firm-specific information (Johnson 2010). We examine the validity of this criticism by dividing the changes in risk sentences into their industry-level and firm-level components. Δ*Risk Disclosure* is divided into Δ*Industry-Level RD*, defined as the four-digit SIC industry median of Δ*Risk Disclosure*, and Δ*Firm-Level RD*, defined as Δ*Risk Disclosure* net of Δ*Industry-Level RD*. The changes in a company's risk disclosure that conform with (deviate from) the changes in risk disclosures of the company's peers are more likely to be industry-specific (firm-specific). This is because mandated risk disclosures stemming from different channels such as new standards, the SEC's interpretations, or the SEC's comment letters affect companies in the same industry similarly in the same year.

2.6.5. Negative emphasis in risk disclosures

Risk disclosures are expected to provide information about downside risk in general. The literature on prospect theory predicts and documents that individuals react to prospects of losses asymmetrically (Kahneman and Tversky 1979; Koonce et al. 2005). Therefore, risk disclosures that emphasize negative outcomes are likely to be more consequential. However, in order to avoid legal consequences for failing to reveal negative news, managers can make negative–but not more useful–risk statements about broad risk factors. In our final set of analysis, we examine the incremental effect of risk disclosures with negative emphasis. We define $\Delta Negative\ RD_{i,t}$ as the change in the number of risk sentences with a negative tone (i.e., risk sentences that involve at least one of the following keywords: "Negative*", "material*", "adverse*", "damage*", "destroy*", "loss", "harm", "catastroph*", "tragic", "destruct*", "serious", and "hamper") divided by the total number of risk sentences.

3 Research Design

Our sample includes firm-year observations with 10-K filings on the SEC *Edgar* universe between years 1994 and 2007, at least one analyst following recorded on I/B/E/S, and non-missing data from Compustat and CRSP databases, and non-missing data for the previous year. Our sample is composed of 28,110 firm-year observations from 4,315 unique firms. The specific number of observations in each test depends upon the availability of the analyst-related variables.

We test how changes in risk disclosures relate with changes in activities of investors and analysts during the two months before and after the filings. We use a changes model in order to examine the effect of new risk disclosures and address potential correlated omitted variables. We estimate the following OLS model (with modifications across different tests) on a pooled times-series cross-sectional basis:

$$
\begin{aligned}
Y = {} & \beta_0 + \beta_1\,\Delta Risk\ Disclosure_{i,t} + \beta_2\,\Delta Other\ Sentences_{i,t} + \beta_3\,\Delta Fog\ Index_{i,t} + \beta_4\,\Delta Log(MCap)_{i,t} \\
& + \beta_5\,\Delta Institutional\ Ownership_{i,t} + \beta_6\,\Delta Managerial\ Forecast_{i,t} + \beta_7\,\Delta Sales\ Growth_{i,t} \\
& + \beta_8\,\Delta ROA_{i,t} + \beta_9\,\Delta Number\ of\ Segments_{i,t} + \beta_{10}\,\Delta Loss_{i,t} + \beta_{11}\,Filing\ Return_{i,t} \\
& + \beta_{12}\,Absolute\ Filing\ Return_{i,t} + \beta_{13}\,\Delta Market\ Return_{i,t} + \beta_{14}\,\Delta Market\ Return\ Volatility_{i,t} + \varepsilon_{i,t}
\end{aligned} \tag{1}
$$

where, in separate tests, Y is equal to the following proxies about changes in users' risk perception: change in volatility of daily stock returns, $\Delta\sigma(Return)$; change in the ratio of volatility of negative stock returns to volatility of positive stock returns, $\Delta(\sigma(Neg\ Return)/\sigma(Pos\ Return))$, change in the three-day trading volume around the 10-K filing, *Log*(*Filing Volume*); change in trading volume, $\Delta Log(Volume)$; indicator of positive changes in forecast dispersion, Δ*Forecast Dispersion*; dispersion of forecast revisions, σ(*Forecast Revision*); and diverging forecast revisions of individual analysts, *KP Forecast Divergence*.

The model controls for changes in firm characteristics that could affect investor and analyst activity around the filings. Specifically, the model controls for the change in the number of non-risk sentences, Δ*Other Sentences*, and readability, Δ*Fog Index*, of the annual report (Li 2008b; You and Zhang 2009); the change in the logarithm of market value of equity from one day before the filings to two months after the filings, Δ*Log*(*MCap*); the quarterly change in the percentage of institutional ownership, Δ*Institutional Ownership*; the change in the number of management forecasts from two months before to two months after the filings, Δ*Managerial Forecast*; the quarterly change in seasonally-adjusted sales growth, Δ*Sales Growth*; the quarterly change in seasonally-adjusted net income divided by total assets, Δ*ROA*; the annual change in the number of business segments, Δ*Number of Segments*; an indicator variable on whether the company switched from a quarterly profit to a loss, Δ*Loss*; the change in the value-weighted market return from the two months before to two months after the filings, Δ*Market Return*, and market return volatility, Δ*Market Return Volatility*. Finally, the model controls for the overall information in the 10-K filings using the signed and absolute value of company's stock returns during the three-day window around the 10-K filing, *Filing Return* and *Absolute Filing Return*, respectively. Appendix C describes the variables in detail. All continuous variables are winsorized at the 1st and 99th percentile to mitigate the effect of outliers. Further, influential observations with studentized t-statistics greater than two are excluded in each test. The standard errors are adjusted for heteroskedasticity and within-firm and filing-month clustering.[12]

4 Results

4.1 Descriptive statistics

Panel A of Table 1 presents descriptive statistics. The mean (median) value of Δ*Risk Disclosure* is 13.7 (6) over our sample period. The untabulated mean (median) of the level variable, *Risk Disclosure*, is 109.9 (87), suggesting that risk disclosures in annual reports grow

[12] The results are essentially the same when standard errors are adjusted for filing quarter or filing year.

by about 10% per year. This comparison is consistent with the ever-increasing emphasis on risk disclosures from companies, regulators, and investors. The distribution of Δ*Risk Disclosure* is right-skewed, consistent with firms making large increases to their risk disclosures in certain years. As discussed in Section 2, we differentiate between risk disclosure changes that coincide with the industry and year, and firm-level changes. Average (median) Δ*Industry-level RD* is 8.9 (7) whereas Δ*Firm-level RD* is 4.8 (0). Average (median) Δ*Negative RD Intensity* is 0.03 (0.02), suggesting a higher negative emphasis in risk disclosures over years.

Appendix B depicts a monotonic increase in risk disclosures over the sample period. There is a slight increase in 1997 and 1998 coinciding with the passage of FRR No. 48 in 1997. Interestingly, firms did not increase their risk disclosures in 1999 and 2000, before investors experienced significant losses. The risk sentences increased sharply, beginning with the market crash in 2001 and passage of the Sarbanes-Oxley Act of 2002. We also observe a large increase in 2005, coinciding with the SEC's mandate that companies discuss their risk factors concerning operations and future cash flows in the first pages of 10-K filings. Overall, the median number of risk sentences increases nine-fold from an average of 19 sentences in 1994 to 170 sentences in 2007 as compared to a three-fold increase in other sentences from an average of 293 in 1994 and 801 in 2007 (untabulated). In sum, the increases in risk disclosures coincides with related regulatory changes over years and provides visual support that our textual analysis reliably captures company risk disclosures.

Panel B of Table 1 presents correlations among key variables. Δ*Risk Disclosure* positively correlates with both firm-level and industry-level changes in risk disclosures. Δ*Risk Disclosure* also positively correlates with Δ*Negative RD Intensity*. Δ*Risk Disclosure* is negatively correlated with Δ*Fog Index*, suggesting more risk disclosures in more readable annual reports. The univariate correlations of Δ*Risk Disclosure* with dependent variables, $\Delta\sigma$(*Return*), *Log*(*Filing Volume*), Δ*Log*(*Volume*), and σ(*Forecast Revision*), are positive and significant at 5%. The correlations suggest that changes in risk disclosures are sources of information that prompt increases in users' risk perceptions. However, it is difficult to interpret the economic significance of the above associations for two reasons. First, Δ*Risk Disclosure* is a quantitative measure of a qualitative economic construct, making it difficult to establish a threshold of economic significance. Second, we test for the dominant effect of risk disclosures where risk disclosures can be consistent with both the divergent and convergent effects so that the dominant effect will be attenuated. These concerns notwithstanding, we provide multivariate analyses on the above relations, and explore the economic significance by comparing the effect of a one standard deviation change in Δ*Risk Disclosure* to the effect of a one standard deviation change in the information content of the 10-K filing as proxied by the stock market reaction to the filing.

4.2 Volatility of daily stock returns

Table 2 presents the results of Eq. (1) testing the effect of changes in risk disclosures on changes in daily stock return volatility (Model 1) and relative change in volatility of negative returns to positive returns (Model 2). For Model 1, the coefficient on Δ*Risk Disclosure* (multiplied by 1,000 for ease of interpretation) is 0.852 and is significant at the 1% level. With respect to the control variables, the change in return volatility is positively associated with the change in Fog index, change in the number of managerial forecasts, and change in market return volatility; and negatively associated with change in loss status, company filing return, and absolute value of company filing return. The change in return volatility is (marginally) negatively related with the changes in non-risk sentences in the 10-K filing, in contrast to the positive effect of changes in risk disclosures (-0.085 versus 0.852). The difference in the estimated coefficients is statistically significant at the 1% level (untabulated). The stark contrast between the two coefficients is consistent with risk disclosures (non-risk disclosures) in 10-K filings resulting in divergent (convergent) interpretations about future performance.

While the coefficient on Δ*Risk Disclosure* is interpreted as the effect of an additional risk sentence on our dependent variable, holding everything else constant, we examine the economic significance relative to the total information content in the 10-K filing. Specifically, we calculate the effect of a one standard deviation change in Δ*Risk Disclosure* (28.7 sentences) relative to the effect of one standard deviation change in *Filing Return* (5.3%) on the dependent variable. When Δ*Risk Disclosure* increases by one standard deviation, Δσ(*Return*) increases by 0.024 (=0.000852*28.7). When *Filing Return* increases by one standard deviation, Δσ(*Return*) decreases by 0.057 (=(-0.746*0.053)+(-0.325*0.053)).[13] This indicates that changes in risk sentences have an effect on Δσ(*Return*) that is 42% (=0.024/0.057) of the effect of comparable changes in the information content of the entire 10-K filing.

For Model 2, the coefficient on Δ*Risk Disclosure* is 0.264 and significant at the 10% level. That is, changes in risk disclosures increase Δ(*σ*(*Neg Return*)/*σ*(*Pos Return*)), suggesting that risk disclosures make negative stock returns more volatile. Similar to Model 1, there is a stark contrast between the estimated coefficients on Δ*Risk Disclosure* and Δ*Other Sentences*, consistent with risk disclosures (non-risk disclosures) in 10-K filings resulting in more divergent (convergent) interpretations about negative contingencies.

When Δ*Risk Disclosure* increases by one standard deviation (28.7 sentences), Δ(*σ*(*Neg Return*)/*σ*(*Pos Return*)) increases by 0.008 (=0.000264*28.7), suggesting that the negative return volatility increases by 0.8% more relative to positive return volatility. When *Filing Return*

[13] Because the absolute value of *Filing Return* is also included in Eq. (1), we include the effect of both *Filing Return* and *Absolute Filing Return* in the computations when both are statistically significant.

increases by one standard deviation, Δ(σ(*Neg Return)*/σ(*Pos Return))* increases by 0.036 (=0.671*0.053), indicating the effect of changes in Δ*Risk Disclosure* is 22% (=0.008/0.036) of the effect of comparable changes in the information content of the entire 10-K filing.

4.3 Trading volume

Table 3, Model 1 tests how changes in risk disclosures affect *Log*(*Filing Volume*), which is the logarithm of average three-day trading volume over the filing date. In addition to the control variables in Eq. (1), the model controls for the normal level of trading volume over the three month period ending two months before the filings, *Log*(*Non-Filing Volume*). The model controls for release of market-wide information by including the value-weighted market return, *Market Return*, and the volatility of the daily market return, *Market Return Volatility*, over the three-day filing date window. The coefficient on Δ*Risk Disclosure* is 0.650 and is significant at the 1% level. With respect to the control variables, *Log*(*Filing Volume*) is significantly and positively associated with the normal level of trading volume, change in institutional ownership, change in the number of managerial forecasts, filing return, and absolute value of the filing return. *Log*(*Filing Volume*) is significantly and negatively associated with the change in *ROA*.

With respect to economic significance, a one standard deviation increase in Δ*Risk Disclosure* increases *Log*(*Filing Volume*) by 0.019 (=0.000650*28.7), holding everything else constant, while a one standard deviation increase in *Filing Return* increases *Log*(*Filing Volume*) by 0.260 (=(0.682*0.053)+(4.22*0.053)). This indicates that changes in risk sentences have an effect on *Log*(*Filing Volume*) that is 7% (=0.019/0.260) of the effect of comparable changes in the information content of the entire 10-K filing.

Table 3, Model 2 tests how changes in risk disclosures affect Δ*Log*(*Volume*), the change in average daily trading volume from the last two months before to the first two months after the

10-K filings. As control variables, the model replaces *Market Return* and *Market Return Volatility* with Δ*Market Return* and Δ*Market Return Volatility*, respectively. The coefficient on Δ*Risk Disclosure* is 0.645 and is significant at the 1% level. With respect to the control variables, Δ*Log*(*Volume*) is positively associated with the change in firm size, change in institutional ownership, and change in the number of managerial forecasts. Δ*Log*(*Volume*) is negatively associated with the change in ROA and the filing return.

With respect to economic significance, a one standard deviation increase in Δ*Risk Disclosure* is associated with change in Δ*Log*(*Volume*) of 0.0185 (=0.000645*28.7), holding everything else constant, while a one standard deviation change in *Filing Return* is associated with a change in Δ*Log*(*Volume*) of 0.0082 (=0.154*0.053). This indicates that changes in risk sentences have an effect on Δ*Log*(*Volume*) that is 225% (=0.0185/0.0082) of the effect of comparable changes in the information content of the entire 10-K filing, holding the effects of other control variables constant. The effect of Δ*Risk Disclosure* relative to *Filing Return* is considerably larger when *Log*(*Filing Volume*) is the dependent variable compared to Δ*Log*(*Volume*). We expect this is due to *Filing Return* having a greater effect on trading volume in the short-term relative to the long-term. Overall, the trading volume results in Models 1 and 2 triangulate our findings on share price volatility. The changes in risk disclosures are associated with economically significant changes in trading volume. Increases in risk disclosures appear to prompt investors to differentially revise their prior beliefs and, in turn, increase their trading during the filing period and after the filing. At the same time, increases in risk disclosures appear to reduce confidence of individual investors in their predictions so that they are more likely to trade with the arrival of new information.

4.4 Dispersion of analyst forecasts

The above evidence of increased trading volume around the filings can also result from risk disclosures converging investors' beliefs that were divergent prior to the filing (Bamber and Cheon 1995). To explain whether users' interpretations converge or diverge, we examine changes in dispersion of analyst forecasts and forecast revisions.

Table 4, Model 1 presents the results of the logistic regression with Δ*Forecast Dispersion* as the dependent variable. In addition to the control variables in Eq. (1), the model includes the change in the number of analysts, Δ*Number of Analysts*, which can affect the standard deviation of analysts' forecasts around the filings. We find a marginally positive association between changes in risk disclosure and increases in the standard deviation of analysts' outstanding forecasts surrounding 10-K filings. The coefficient on Δ*Risk Disclosure* is 1.813 and is marginally significant at the 10% level, consistent with increases in risk disclosures increasing analysts' overall uncertainty about future company earnings. These effects are consistent with the divergence argument, which predicts that risk disclosures reveal information about unknown risk factors. With respect to the control variables, Δ*Forecast Dispersion* is positively associated with the change in market return, change in volatility of the market return, and change in the number of analysts; and negatively associated with the change in firm size and ROA.

We evaluate the economic significance in this logistic regression by calculating the marginal probability at the mean value of Δ*Risk Disclosure*, holding other variables at their mean values. The marginal probability for Δ*Risk Disclosure* is 0.05%. This marginal probability corresponds to an increase of 1.4% in the probability of a positive change in forecast dispersion if Δ*Risk Disclosure* increases by one standard deviation.

4.5 Volatility and divergence of analyst forecast revisions

We examine the relation between changes in risk disclosure and the standard deviation of individual analysts' forecast revisions, σ(*Forecast Revision*), around the filings. In addition to the control variables in Eq. (1), the regression model includes *Number of Analysts* as a control variable, because the number of analysts can affect the level of noise in forecast revisions. Table 4, Model 2 presents the regression results. The coefficient on Δ*Risk Disclosure* is 0.008 and is significant at the 5% level, suggesting that risk disclosures prompt analysts to make more volatile changes to their one-year-ahead earnings forecasts. With respect to the control variables, volatility of forecast revisions is positively associated with the change in ROA, change in the occurrence of a net loss, absolute value of the filing return, and change in the market return; and negatively associated with the change in firm size, change in sales growth, and change in the volatility of the market return.

To evaluate economic significance, a one standard deviation increase in Δ*Risk Disclosure* is associated with a change in σ(*Forecast Revision*) of 0.00023 (=0.000008*28.7), holding everything else constant. When *Filing Return* increases by one standard deviation, σ(*Forecast Revision*) increases by 0.00122 (=0.023*0.053), indicating the effect of changes in Δ*Risk Disclosure* is 19% (=0.00023/0.00122) of the effect of comparable changes in the information content of the entire 10-K filing.

Next, we test whether individual analysts differentially interpret the changes in risk disclosures. We use the *KP Forecast Divergence* measure, which is the proportion of pairs of analysts' forecasts that i) move in opposite direction (i.e., one forecast is revised upward while the other is revised downward), and ii) either flip or diverge around the 10-K filing. Table 4, Model 3 presents the regression results. The coefficient on Δ*Risk Disclosure* is 0.116 and is not significant at conventional levels. With respect to the control variables, we find that only the filing return is positively associated with *KP Forecast Divergence*. While prior research has not explored other determinants of the *KP Forecast Divergence* measure, the adjusted R-square of 0.1% suggests the existence of substantial amount of variation that is unexplained by the variables in our model. Collectively, the above results are consistent with the divergent effect being more dominant. Analysts appear to issue more divergent forecasts and diverge in their revisions when changes in risk disclosures are higher.

4.6 Firm-level versus industry-level risk disclosures

We reperform the above tests by dividing Δ*Risk Disclosure* into Δ*Firm-Level RD* and Δ*Industry-Level RD*. Table 5, Panel A provides results for regressions where return volatility, Δσ(*Return*), negative return volatility, Δ(*σ*(*Neg Ret*)/*σ*(*Pos Ret*)), filing volume, *Log*(*Filing Volume*), and changes in trading volume, ΔLog(*Volume*), are dependent variables. The control variables are included in the regressions but not in the table for brevity. The coefficients on Δ*Industry-Level RD* are positive and significant in all models. The coefficients on Δ*Firm-Level RD* are positive and significant in all models except that with negative return volatility as the dependent variable. Most importantly, in all models, the estimated coefficients on Δ*Industry-Level RD* are significantly higher than those on Δ*Firm-Level RD*.

Similarly, Table 5, Panel B provides results for regressions with change in forecast dispersion, Δ*Forecast Dispersion*, volatility of forecast revisions, σ(*Forecast Revision*), and divergence measure of revisions, *KP Forecast Divergence*, as dependent variables. The coefficients on Δ*Industry-Level RD* are positive and significant in all models. In contrast, the coefficients on Δ*Firm-Level RD* are insignificant in all models. The coefficients on Δ*Industry-Level RD* are higher than those on Δ*Firm-Level RD* (the differences are statistically significant in two out of the three models). The results collectively suggest that industry-level changes in risk disclosures are significantly more effective than firm-level changes in changing investors' risk perceptions. This is consistent with the criticism that risk disclosures lack useful firm-specific details.

4.7 Risk disclosures emphasizing negative outcomes

In our final set of tests, we investigate whether a negative emphasis in risk disclosures incrementally impacts users' risk perceptions. Empirically, we reperform our tests by including the change in risk sentences that have negative keywords, Δ*Negative RD Intensity*, and its interaction with Δ*Risk Disclosure*.

Panels A and B of Table 6 provide results of our tests about the risk perceptions of investors and analysts, respectively. The coefficients on Δ*Risk Disclosure**Δ*Negative RD Intensity* are negative and significant when Δσ(*Return*), *Log*(*Filing Volume)*, Δ*Log*(*Volume*), and σ(*Forecast Revision*) are dependent variables, and insignificant for the remaining three models. Overall, risk disclosures with negative disclosures reduce users' risk perceptions. The implication of this result is that managers provide less informative disclosures about unknown risks (but potentially more informative disclosures about known risks) when emphasizing negative outcomes. This is important, because risk disclosures are criticized more when unpredicted negative outcomes occur and investors are not forewarned about these outcomes.

4.8 Alternative explanations

Annual reports may not reveal contingencies and risk factors but only correlate with changes in company risks that users learn from other information sources. This alternative explanation is likely not driving our results for three reasons. First, we investigate changes in investor and analyst activity during the two-month periods immediately before and after 10-K filing dates, so other information sources would have to be concentrated around 10-K filing dates to explain the documented changes in analyst and investor activity. Second, our research design controls for changes in other information sources such as market capitalization, institutional investors, management earnings forecasts, sales growth, ROA, number of business segments, and reporting of losses. Non-risk information in the 10-K filings as well as the readability of the annual report is also controlled for through the total number of non-risk sentences and the Fog index. We also control for changes in economic risk factors using the change in the market return and volatility of the market return.[14] Third, we find consistent results in the short-window trading volume test where the release of other risk-related information is a substantially less plausible alternative explanation. Nevertheless, this alternative explanation, even if valid, suggests that company risk disclosures, though not timely, are not boilerplate and do reflect corporate risk exposures. While this interpretation affects some of our inferences, we argue it does not decrease the contribution of our study in understanding the broad-based textual risk disclosures in 10-K filings.

In untabulated tests, we incorporate the ability for increases and decreases in risk disclosures to affect users' risk perceptions differently. We include in the tests from Tables 2 to 4, an interaction term of Δ*Risk Disclosure* with an indicator variable for negative Δ*Risk Disclosure*. We also include in the tests from Table 5, using firm-level and industry-level risk disclosures, an interaction term of Δ*Firm-Level RD* with an indicator variable for negative Δ*Firm-Level RD*. We do not find any consistent evidence that annual increases and decreases in risk disclosures have differential effects on investors' risk perceptions. This finding mitigates concerns about non-linearity of the relation between risk disclosures and risk perceptions.

[14] In untabulated tests, we include firm fixed effects and find similar results as those that are reported.

5 Conclusion

In this paper, we test how annual changes in textual risk-based disclosures in 10-K filings impact users' risk perceptions, as measured by investor and analyst activities within the immediate two months before and after the 10-K filings. The empirical tests use a changes methodology, and thus are relatively void of problems confounding the interpretation of the findings such as correlated omitted factors.

We find that annual changes in risk disclosures are significantly and positively associated with changes in daily stock return volatility, changes in volatility of negative daily returns, filing volume, changes in trading volume, changes in dispersion of outstanding forecasts, and volatility of forecast revisions. The results are of an economically significant magnitude when compared to the effect of the total information content of the 10-K filing. These results reject the null argument that risk disclosures are uninformative. Consistent with the divergence argument dominating the convergence argument, company risk disclosures appear to introduce unknown future contingencies and risk factors rather than only update information about known risks. This appears to widen the range of individual users' predictions of future performance as well as decrease their confidence levels in their predictions. Our findings contrast with those in prior literature, which generally documents a negative correlation between company disclosures and divergence in market participants' beliefs.

As standard setters tighten risk disclosure standards in response to the recent economic crisis, we document evidence that textual risk disclosures on average reveal new information about corporate risks and uncertainties. However, two elements of risk disclosures that are particularly important to users, idiosyncratic firm-specific disclosures and forewarnings of negative outcomes, are less informative and represent a potential focus for standard setters.

Appendix A Identifying risk disclosures

Step 1: Obtaining electronic 10-K filings

We download 10-K filings (annual reports) for fiscal years between 1994 and 2007 from the *SEC Edgar* database. Prior to 2002, companies filed their 10-K filings in the ASCII-code text format. After 2002, companies have uploaded their annual reports in various formats, such as text, html, or pdf formats. Since the Perl code handles only ASCII-code text files most accurately, we supplement our post-2002 sample annual reports obtained from the *10-K Wizard* database in rich text format. We use the TextPipe Software to convert the rich text formatted files from *10-K Wizard* to the ASCII-code text formatted files. We then match the CIK of the Edgar filings with the GVKEY identifier in WRDS to obtain the required financial and stock market related data.

Step 2: Extracting risk disclosures from 10-K filings

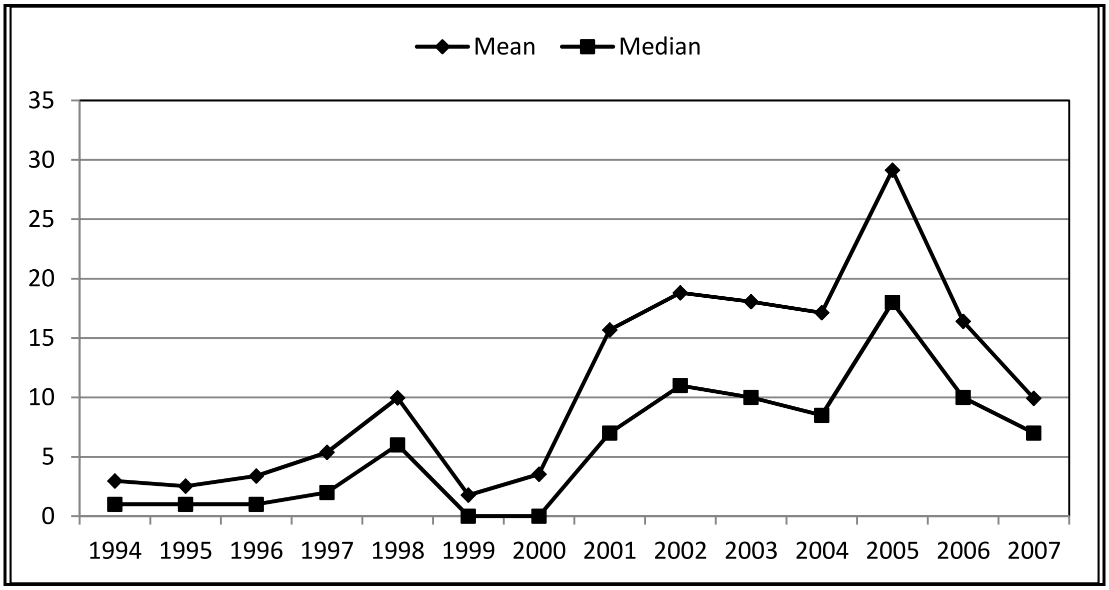
We search for full sentences that involve the following risk-related keywords (where a '*' implies that suffixes are allowed): "can", "cannot", "could", "may", "might", "risk*", "uncertain*", "likely to" "subject to" "potential*", "vary*", "varies", "depend*", "expos*", "fluctuat*", "possibl*", "susceptible", "affect", " influenc*", and " hedg*".

We tag a sentence as risk disclosure if it contains at least one of the above keywords.

Step 3: Analyzing the negative tone in risk disclosures

We further categorize risk-disclosure sentences according to whether they contain a negative tone. A risk disclosure sentence is identified as having *negative tone* if it includes one or more of the following keywords and their variations: "Negative*", "material*", "adverse*", "damage*", "destroy*", "loss", "harm", "catastroph*", "tragic", "destruct*", "serious", and "hamper".

Appendix B Change in number of corporate risk sentences by year



The graph presents the mean and median change in the number of risk sentences by year. The sample includes 28,110 available annual changes in the number of risk sentences collected from the 10-K filings of companies between years 1994 and 2007.

Appendix C Variable definitions

Δ*Risk Disclosure*$_{i,t}$	The change in the number of sentences that contain risk keywords between firm i's 10-K filings for fiscal years t and t-1.
Δ*Industry-Level RD*$_{i,t}$	The industry and year-median of Δ*Risk Disclosure*$_{i,t}$, where industry is defined by 4-digit SIC codes.
Δ*Firm-Level RD*$_{i,t}$	The industry and year median-adjusted value of Δ*Risk Disclosure*$_{i,t}$, calculated as Δ*Risk Disclosure*$_{i,t}$ - Δ*Industry-Level RD*$_{i,t}$.
Δ*Negative RD Intensity*$_{i,t}$	The change in the number of sentences that contain both risk keywords and keywords with a negative tone between firm i's 10-K filings for fiscal years t and t-1, divided by the total number of risk sentences.
Δ*Other Sentences*$_{i,t}$	The change in the number of sentences that do not contain risk keywords between firm i's 10-K filings for fiscal years t and t-1.
Δ*Fog Index*$_{i,t}$	The change in the Fog Index of firm i's 10-K filings between fiscal years t and t-1. The Fog Index is calculated as (average words per sentence + percent of complex words) * 0.4 (Li 2008b).
$\Delta\sigma$(*Return*)$_{i,t}$	The change in the standard deviation of firm i's daily stock returns between the last two months before and the first two months after the 10-K filing for fiscal year t. This variable is multiplied times 100 to be presented as a percentage.
Δ(σ(*Neg Return*)/σ(*Pos Return*))$_{i,t}$	The change in the ratio of σ(*Neg Return*)$_{i,t}$/σ(*Pos Return*)$_{i,t}$, between the last two months before and the first two months after the 10-K filing for fiscal year t. σ(*Neg Return*)$_{i,t}$ (σ(*Pos Return*)$_{i,t}$) is the standard deviation of daily stock returns during trading days with negative (positive) returns where days with positive (negative) returns are valued at zero.
Log(*Filing Volume*)$_{i,t}$	The natural logarithm of firm i's average daily trading volume divided by outstanding shares in the three-day window surrounding the 10-K filing for fiscal year t.
Δ*Log*(*Volume*)$_{i,t}$	The change in firm i's natural logarithm of the average daily trading volume divided by outstanding shares between the last two months before and the first two months after the 10-K filing for fiscal year t.
Δ*Forecast Dispersion*$_{i,t}$	An indicator variable equal to one if the standard deviation of analyst forecasts of firm i's fiscal year t+1 earnings issued during the last two months before the 10-K filing is greater than the standard deviation of forecasts issued during the first two months after the filing.
σ(*Forecast Revision*)$_{i,t}$	The standard deviation of analyst forecast revisions of firm i's fiscal year t+1earnings. The forecast revisions are calculated as individual analysts' first forecasts during the first two months after the 10-K filing for fiscal year t minus their last forecasts during the last two months before the filing.

KP Forecast Divergence$_{i,t}$	The proportion of all possible pairs of forecast revisions around fiscal year t's 10-K filing that i) move in opposite direction (i.e., one forecast is revised upward while the other is revised downward), and ii) either flip or diverge. The measure uses individual analysts' revisions of fiscal year t+1 earnings from analysts' last forecasts during the last two months before to their first forecast during the first two months after the filing (Kandel and Pearson 1995)
Δ*Log*(*MCap*)$_{i,t}$	The change in the natural logarithm of firm i's market value of equity between 2 days before and 60 days after the 10-K filing for fiscal year t.
Δ*Institutional Ownership*$_{i,t}$	The change in the percentage of institutional ownership between the end of the last fiscal quarter before and the end of the first fiscal quarter after the 10-K filing for fiscal year t.
Δ*Managerial Forecast*$_{i,t}$	The change in the number of management forecasts between the last two months before and the first two months after the 10-K filing for fiscal year t.
Δ*Sales Growth*$_{i,t}$	The change in the seasonally-adjusted sales growth between the fourth quarter of fiscal year t and the first quarter of fiscal year t+1, where seasonally-adjusted quarterly sales growth is calculated as sales in quarter q divided by sales in quarter q-4.
Δ*ROA*$_{i,t}$	The change in the seasonally-adjusted net income between the fourth quarter of fiscal year t and the first quarter of fiscal year t+1, where seasonally-adjusted net income is calculated as the change in net income before extraordinary items from the same prior fiscal quarter divided by total assets.
Δ*Number of Segments*$_{i,t}$	The change in the number of firm i's business segments between fiscal years t-1 and t.
Δ*Loss*$_{i,t}$	An indicator variable equal to one if firm i does not report a net loss in the fourth fiscal quarter of fiscal year t and reports a net loss in the first fiscal quarter of fiscal year t+1.
Filing Return$_{i,t}$	Firm i's stock returns over the three-day period [-1, 1] surrounding the 10-K filing for fiscal year t.
Absolute Filing Return$_{i,t}$	The absolute value of firm i's return over the three-day period [-1, 1] surrounding the 10-K filing for fiscal year t.
Log(*Non-Filing Volume*)$_{i,t}$	The average natural logarithm of firm i's daily trading volume divided by outstanding shares between the five months and two months prior to the 10-K filing for fiscal year t.
Market Return$_{i,t}$	The value-weighted market return over the three-day period [-1, 1] surrounding the 10-K filing for fiscal year t.
Market Return Volatility$_{i,t}$	The volatility of the daily value-weighted market return over the three-day period [-1, 1] surrounding the 10-K filing for fiscal year t.

Δ*Market Return*$_{i,t}$	The change in the value-weighted market returns between the last two months before and the first two months after the 10-K filing for fiscal year t.
Δ*Market Return Volatility*$_{i,t}$	The change in the volatility of the daily value-weighted market return between the last two months before and the first two months after the 10-K filing for fiscal year t.
Number of Analysts$_{i,t}$	The number of analysts that issue forecasts of fiscal year t+1 earnings during the two months before and after the 10-K filing for fiscal year t.
Δ*Number of Analysts*$_{i,t}$	The change in the number of analysts issuing forecasts between the last two months before and the first two months after the 10-K filing for fiscal year t.

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Table 1 Sample

Panel A: Descriptive statistics

	N	Mean	Median	Standard Deviation	Lower Quartile	Upper Quartile
Δ*Risk Disclosure*	28,110	13.749	6.000	28.744	-1.000	21.000
Δ*Firm-Level RD*	28,110	4.799	0.000	26.302	-6.500	10.000
Δ*Industry-Level RD*	28,110	8.863	7.000	10.485	1.500	13.000
Δ*Negative RD Intensity*	28,110	0.030	0.019	0.091	0.000	0.066
Δ*Other Sentences*	28,110	45.767	23.000	141.298	-9.000	82.000
Δ*Fog Index*	28,110	-0.110	0.000	3.695	-1.359	1.182
Δσ(*Return*)	28,110	-0.010	-0.006	1.185	-0.490	0.451
Δ(*σ*(*Neg Return*)/*σ*(*Pos Return*))	28,110	0.005	0.003	0.437	-0.244	0.253
Log(*Filing Volume*)	28,110	-1.448	-1.179	1.650	-2.167	-0.381
Δ*Log*(*Volume*)	28,110	0.045	0.018	0.501	-0.223	0.280
Δ*Forecast Dispersion*	6,023	0.491	0.000	0.500	0.000	1.000
σ(*Forecast Revision*)	4,502	0.005	0.002	0.013	0.001	0.005
KP Forecast Divergence	4,502	0.152	0.092	0.172	0.000	0.288
Δ*Log*(*MCap*)	28,110	0.028	0.023	0.208	-0.069	0.127
Δ*Institutional Ownership*	28,110	0.007	0.001	0.053	-0.011	0.025
Δ*Managerial Forecast*	28,110	-0.070	0.000	0.818	0.000	0.000
Δ*Sales Growth*	28,110	-0.008	-0.003	0.310	-0.084	0.075
Δ*ROA*	28,110	-0.002	0.000	0.061	-0.008	0.007
Δ*Number of Segments*	28,110	0.044	0.000	0.370	0.000	0.000
Δ*Loss*	28,110	0.065	0.000	0.247	0.000	0.000
Filing Return	28,110	-0.001	-0.001	0.053	-0.023	0.020
Absolute Filing Return	28,110	0.036	0.021	0.043	0.009	0.045
Market Return	28,110	-0.001	0.000	0.018	-0.011	0.009
Market Return Volatility	28,110	0.009	0.008	0.006	0.005	0.013
Δ*Market Return*	28,110	0.010	-0.006	0.104	-0.050	0.063
Δ*Market Return Volatility*	28,110	0.000	0.000	0.003	-0.001	0.002
Non-Filing Volume	28,110	-1.513	-1.246	1.574	-2.263	-0.461
Δ*Number of Analysts*	4,502	8.903	7.000	4.237	6.000	11.000
Δ*Number of Analysts*	6,023	0.955	1.000	3.637	-1.000	3.000

Panel B: Pearson (top) and Spearman (bottom) correlation coefficients

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	Δ*Risk Disclosure*		**0.92**	**0.40**	**0.54**	**0.62**	**-0.05**	**0.01**	0.00	**0.10**	**0.02**	**0.03**	**0.05**	0.01
(2)	Δ*Firm-Level RD*	**0.83**		**0.03**	**0.48**	**0.60**	**-0.05**	0.01	0.00	**0.07**	0.00	0.02	**0.04**	0.00
(3)	Δ*Industry-Level RD*	**0.44**	**-0.03**		**0.27**	**0.19**	**-0.02**	**0.03**	**0.02**	**0.10**	**0.07**	0.02	**0.03**	0.02
(4)	Δ*Negative RD Intensity*	**0.64**	**0.53**	**0.29**		**0.34**	**-0.02**	0.00	0.00	**0.02**	**0.03**	0.02	0.00	-0.02
(5)	Δ*Other Sentences*	**0.58**	**0.49**	**0.25**	**0.36**		**-0.05**	0.01	**-0.01**	**0.06**	**0.01**	0.02	**0.03**	0.00
(6)	Δ*Fog Index*	**-0.02**	**-0.02**	-0.01	0.01	**-0.01**		0.00	0.00	-0.01	0.01	0.02	-0.01	0.00
(7)	Δ*σ(Return)*	**0.02**	0.01	**0.04**	0.01	0.01	0.01		**-0.09**	**-0.06**	**0.30**	**0.07**	**-0.08**	**-0.04**
(8)	Δ(*σ*(*Neg Return*)/*σ*(*Pos Return*))	0.00	-0.01	0.01	0.00	-0.01	0.00	**-0.10**		**0.02**	**-0.05**	**0.04**	-0.03	**-0.05**
(9)	*Log*(*Filing Volume*)	**0.12**	**0.07**	**0.15**	**0.03**	**0.08**	0.00	**-0.05**	**0.04**		**-0.06**	0.02	**0.11**	-0.02
(10)	Δ*Log*(*Volume*)	**0.04**	0.00	**0.08**	**0.03**	**0.02**	0.01	**0.28**	**-0.05**	**-0.04**		**0.07**	0.00	**-0.07**
(11)	Δ*Forecast Dispersion*	0.02	0.01	0.02	0.01	0.01	0.02	**0.08**	**0.03**	0.02	**0.08**		-0.02	**-0.15**
(12)	*σ*(*Forecast Revision*)	**0.08**	**0.05**	**0.12**	0.00	**0.04**	-0.01	**-0.03**	**-0.03**	**0.19**	0.01	**-0.05**		**0.10**
(13)	*KP Forecast Divergence*	0.01	-0.01	0.03	-0.02	0.01	0.00	-0.02	**-0.05**	0.00	**-0.07**	**-0.16**	**0.20**	

Panel A of Table 1 presents descriptive statistics of the variables used in the tests. Panel B presents the correlation coefficients; bold numbers indicate statistical significance at the 5% level. Variable descriptions appear in Appendix C. All regression variables are winsorized at the 1^{st} and 99^{th} percentile except for indicator variables.

Table 2 Change in volatility of stock returns

	(1) Δσ(*Return*)		(2) Δ(σ(*Neg Return*)/σ(*Pos Return*))	
	Coefficient	T-statistic	Coefficient	T-statistic
Intercept	-0.016	-0.69	0.031	2.94***
Δ*Risk Disclosure (x 1,000)*	0.852	3.12***	0.264	1.93*
Δ*Other Sentences (x 1,000)*	-0.085	-1.62	-0.047	-1.84*
Δ*Fog Index(x 1,000)*	3.110	1.92*	-0.112	-0.25
Δ*Log*(*MCap*)	0.050	0.66	-0.669	-21.36***
Δ*Institutional Ownership*	-0.018	-0.15	0.478	7.33***
Δ*Managerial Forecast*	0.056	8.20***	0.014	5.12***
Δ*Sales Growth*	-0.014	-0.66	0.002	0.22
Δ*ROA*	-0.032	-0.27	-0.207	-4.77***
Δ*Number of Segments*	0.004	0.20	-0.023	-3.12***
Δ*Loss*	-0.043	-1.79*	0.024	2.99***
Filing Return	-0.746	-3.98***	0.671	13.82***
Absolute Filing Return	-0.325	-2.13**	-0.037	-0.42
Δ*Market Return*	-0.166	-0.42	-0.272	-3.33***
Δ*Market Return Volatility*	34.134	2.83***	2.675	1.50
N	26,260		26,473	
Adj. R^2	2.0%		18.0%	

This table tests the association between changes in 10-K risk disclosures and changes in the volatility of stock returns and negative stock returns between the first two months after and the last two months before the 10-K filing dates. Variable descriptions appear in Appendix C. All regression variables are winsorized at the 1st and 99th percentile, except for indicator variables, and influential observations with studentized t-statistics greater than two are excluded. The standard errors are White adjusted and clustered by firm and filing month. *, **, and *** denote two-tailed statistical significance at 10%, 5%, and 1% respectively.

Table 3 Trading volume

	(1) *Log*(*Filing Volume*)		(2) Δ*Log*(*Volume*)	
	Coefficient	T-statistic	Coefficient	T-statistic
Intercept	-0.235	-10.94***	-0.069	-6.57***
Δ*Risk Disclosure (x 1,000)*	0.650	4.41***	0.645	3.62***
Δ*Other Sentences (x 1,000)*	-0.019	-0.58	-0.006	-0.23
Δ*Fog Index(x 1,000)*	-0.060	-0.06	0.625	1.17
Log(*Non-Filing Volume*)	0.893	144.34***	-0.050	-12.52***
Δ*Log*(*MCap*)	0.013	0.38	0.488	15.26***
Δ*Institutional Ownership*	0.208	2.58***	0.302	5.66***
Δ*Managerial Forecast*	0.009	3.23***	0.017	6.77***
Δ*Sales Growth*	-0.007	-0.47	0.004	0.46
Δ*ROA*	-0.130	-1.89*	-0.151	-3.42***
Δ*Number of Segments*	-0.006	-0.63	-0.003	-0.40
Δ*Loss*	-0.013	-0.85	-0.001	-0.05
Filing Return	0.682	6.02***	-0.154	-2.40**
Absolute Filing Return	4.220	18.08***	0.243	1.17
Market Return	-0.672	-1.03		
Market Return Volatility	1.079	0.56		
Δ*Market Return*			-0.020	-0.13
Δ*Market Return Volatility*			-1.151	-0.39
N	26,503		26,288	
Adj. R^2	85.2%		10.6%	

The first model tests the association between changes in 10-K risk disclosures and the trading volume over the three-day window surrounding the 10-K filing [-1, 1]. The second model tests the association between changes in 10-K risk disclosures and changes in trading volume surrounding 10-K filing dates from two months before the filing to two months after the filing. Variables definitions appear in Appendix C. All regression variables are winsorized at the 1^{st} and 99^{th} percentile, except for indicator variables, and influential observations with studentized t-statistics greater than two are excluded. The standard errors are White adjusted and clustered by firm and filing month. *, **, and *** denote two-tailed statistical significance at 10%, 5%, and 1% respectively.

Table 4 Dispersion of forecasts and divergence of forecast revisions

	(1) *ΔForecast Dispersion*		(2) σ(*Forecast Revision*)		(3) *KP Forecast Divergence*	
	Coefficient	Z-statistic	Coefficient	T-statistic	Coefficient	T-statistic
Intercept	-0.143	-3.64***	0.003	9.35***	0.135	16.91***
ΔRisk Disclosure (x 1,000)	1.813	1.74*	0.008	2.36**	0.116	0.86
ΔOther Sentences (x 1,000)	0.052	0.28	-0.001	-1.46	-0.021	-0.87
ΔFog Index(x 1,000)	9.641	1.41	-0.006	-0.38	-0.005	-0.01
ΔLog(*MCap*)	-0.509	-2.20**	-0.002	-2.31**	0.005	0.30
ΔInstitutional Ownership	-0.092	-0.16	0.001	0.92	-0.036	-1.08
ΔManagerial Forecast	0.047	1.63	0.000	0.56	0.003	1.34
ΔSales Growth	0.101	1.10	-0.001	-3.58***	-0.017	-1.44
ΔROA	-1.270	-1.97**	0.009	3.40***	0.057	1.57
ΔNumber of Segments	-0.023	-0.37	0.000	-1.42	0.002	0.21
ΔLoss	0.085	0.78	0.004	8.50***	-0.008	-0.74
Filing Return	-0.273	-0.55	0.003	1.23	0.147	2.01**
Absolute Filing Return	0.052	0.06	0.023	5.01***	0.015	0.15
ΔMarket Return	0.924	2.68***	0.002	1.91*	0.017	0.40
ΔMarket Return Volatility	19.945	1.73*	-0.061	-1.68*	-0.468	-0.42
Number of Analysts			0.000	0.80	0.000	0.43
ΔNumber of Analysts	0.076	9.65***				
N	6,023		4,395		4,354	
Adj. R^2 (Pseudo R^2)	1.8%		5.9%		0.1%	

This table tests the association between changes in 10-K risk disclosures and changes in the dispersion of analysts' forecasts, volatility of forecast revisions, and KP forecast divergence measure surrounding 10-K filing dates. Variable descriptions appear in Appendix C. All regression variables are winsorized at the 1st and 99th percentile, except for indicator variables, and influential observations with studentized t-statistics greater than two are excluded. The standard errors are White adjusted and clustered by firm and filing month. *, **, and *** denote two-tailed statistical significance at 10%, 5%, and 1% respectively.

Table 5 Firm-level versus industry-level risk disclosures

Panel A: Return volatility, downside risk, trading volume

	(1) Δσ(*Return*)		(2) Δ(*σ*(*Neg Ret*)/*σ*(*Pos Ret*))		(3) *Log*(*Filing Volume*)		(4) Δ*Log*(*Volume*)	
	Coeff.	T-stat	Coeff.	T-stat	Coeff.	T-stat	Coeff.	T-stat
Δ*Firm-Level RD*	0.429	2.18**	0.119	1.20	0.312	2.11**	0.218	1.77*
Δ*Industry-Level RD*	3.180	3.38***	1.149	2.46**	2.745	4.71***	3.274	4.03***
Test*:*Δ*Firm-Level RD*=Δ*Industry-Level RD*		2.91***		2.26**		4.00***		3.78***
N	26,255		26,470		26,502		26,275	
Adj. R^2	2.1%		18.0%		85.2%		11.2%	

Panel B: Analyst forecast dispersion, volatility of forecast revisions, and divergence of forecast revisions

	(1) Δ*Forecast Dispersion*		(2) σ(*Forecast Revision*)		(3) *KP Forecast Divergence*	
	Coeff.	Z-stat	Coeff.	T-stat	Coeff.	T-stat
Δ*Firm-Level RD*	1.105	0.93	0.005	1.31	0.016	0.13
Δ*Industry-Level RD*	4.517	2.49**	0.023	2.35**	0.563	2.43**
Test*:*Δ*Firm-Level RD*=Δ*Industry-Level RD*		1.63		1.95*		2.43**
N	6,023		4,395		4,353	
Adj. R^2	1.8%		6.1%		0.0%	

This table tests the association between changes in the firm-level and industry-level 10-K risk sentences and changes in stock return volatility, trading volume, and analyst forecast characteristics. The control variables are not displayed for brevity. Variable descriptions appear in Appendix C. All regression variables are winsorized at the 1^{st} and 99^{th} percentile, except for indicator variables, and influential observations with studentized t-statistics greater than two are excluded. The standard errors are White adjusted and clustered by firm and filing month. *, **, and *** denote two-tailed statistical significance at 10%, 5%, and 1% respectively.

Table 6 Effect of risk disclosures containing negative tone

Panel A: Return volatility, downside risk, trading volume

	(1) $\Delta\sigma(Return)$		(2) $\Delta(\sigma(Neg\ Ret)/\sigma(Pos\ Ret))$		(3) $Log(Filing\ Volume)$		(4) $\Delta Log(Volume)$	
	Coeff.	T-stat	Coeff.	T-stat	Coeff.	T-stat	Coeff.	T-stat
Δ*Risk Disclosure*	0.012	3.97***	0.154	0.75	1.078	4.89***	0.901	5.90***
Δ*Negative RD Intensity*	-0.419	-0.66	38.620	1.44	-50.757	-1.19	32.612	0.68
Δ*Risk Disclosure**Δ*Negative RD Intensity*	-0.025	-2.22**	0.327	0.44	-2.815	-2.69***	-2.499	-4.23***
N	26,258		26,469		26,500		26,281	
Adj. R^2	2.0%		18.0%		85.2%		10.6%	

Panel B: Analyst forecast dispersion, volatility of forecast revisions, and divergence of forecast revisions

	(1) Δ*Forecast Dispersion*		(2) σ(*Forecast Revision*)		(3) *KP Forecast Divergence*	
	Coeff.	Z-stat	Coeff.	T-stat	Coeff.	T-stat
Δ*Risk Disclosure*	2.173	1.70	0.018	4.21***	0.353	1.94*
Δ*Negative RD Intensity*	54.447	0.18	-2.677	-2.40**	-85.467	-2.40**
Δ*Risk Disclosure**Δ*Negative RD Intensity*	-3.696	-0.73	-0.048	-2.80***	-0.779	-1.37
N	6,023		4,394		4,355	
Adj. R^2	1.8%		6.3%		0.2%	

This table tests the association between changes in 10-K risk sentences that contain a negative tone and changes in stock return volatility, trading volume, and analyst forecast characteristics. Δ*Negative RD Intensity* is the change in the number of risk sentences in firms' 10-K filings that contain a negative tone divided by the total number of risk sentences. Appendix A explains the method for counting negative risk sentences. The control variables are not displayed for brevity. Variable descriptions appear in Appendix C. All regression variables are winsorized at the 1^{st} and 99^{th} percentile, except for indicator variables, and influential observations with studentized t-statistics greater than two are excluded. The standard errors are White adjusted and clustered by firm and filing month. *, **, and *** denote two-tailed statistical significance at 10%, 5%, and 1% respectively.