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Full Length Article

The value relevance of risk-related disclosure: Does the tone of disclosure matter?☆

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Abstract

This paper investigates whether risk-related disclosure, which includes aggregate risk disclosure and its tone, including upside and downside risk disclosures, is value relevant for investors in the UK market. Based on 1941 firm-year observations for nonfinancial firms listed on the FTSE All-Share, we employ fixed-effect estimations and find that the value relevance of aggregate risk information is not statistically observable unless a distinction is made in its tone. Specifically, upside- (downside-) risk disclosure significantly increases (decreases) stock prices. We also find that the value relevance of risk information exhibits cross-sectional variations conditional on firms' growth and profitability. In particular, we find an asymmetric response of stock prices to upside- and downside-risk disclosures for high-growth firms but not those with low growth. In addition, profit-making firms, but not loss-making firms, provide upside and downside disclosures that significantly influence stock prices. Our paper contributes to the extant research on value relevance and risk reporting by providing new evidence on the extent to which, and how, combining the accounting numbers that are examined extensively in prior research with non-accounting information (i.e., risk information) is important for observing value relevance. Our paper also advances prior research on the usefulness of risk disclosure by looking at the tone of this information and how the market responds to each type of disclosure.

JEL classification: G24; G32; M41; M48

Keywords: Automated textual analysis; Risk-related disclosure; Upside and downside-risk disclosures; Value relevance

1. Introduction

Exploring the value relevance of narrative sections of annual reports is becoming increasingly imperative, as these sections are getting longer and more complex (e.g., Beattie, 2014). In these sections, firms provide information about their risks, which assists investors in the assessment of firms' riskiness, enabling them to revise their uncertainty levels and make better estimates of their required rate of return on investment (e.g., Campbell et al., 2014; Kravet & Muslu, 2013).

Some prior studies have investigated the impact of aggregate risk disclosure (mainly those required by the Securities and Exchange Commission [SEC]) on market indicators in the US, including market liquidity, as in Campbell et al. (2014), and investor-perceived risk, as in Kravet and Muslu (2013);

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they provide mixed results. Specifically, Campbell et al. (2014) suggest that risk disclosure in specific sections in form 10-K (item 1.A: Risk Factor) is useful. However, Kravet and Muslu (2013) study the risk disclosure in the entire 10-K filing, rather than specific sections, and conclude that it is moderately useful.

Despite their intriguing findings, these studies neither investigate whether risk information has value relevance incremental to traditional accounting information nor look at the value relevance of the tone of risk information. This distinction seems to be important, as Kothari et al. (2009) suggest that the market is likely to react to the tone of news (positive or negative), rather than the level of disclosure. Kravet and Muslu (2013) also call for future research to capture the tone in textual risk disclosure. Our paper fills this gap by investigating whether the tone of risk information is value relevant to the stock market.

We focus on examining the value relevance of risk disclosure in the UK market. In a recent review, Elshandidy et al. (2018) conclude that most of the work conducted in the UK concerns the main incentives for revealing information about risk in the narrative disclosures. Researchers build their arguments overwhelmingly on the theoretical basis that firms have a motive for revealing risk information as it will benefit investors, enabling the firms to better allocate their resources. The question of the extent to which—and how—investors in the UK market incorporate risk disclosure and its tone (upside/downside) into share prices (if they do so at all) is still empirically open.[1]

Our results suggest that the value relevance of aggregate risk information is not statistically observable unless a distinction is made in its tone. Specifically, upside (downside) risk disclosure significantly increases (decreases) stock prices. We also find that the value relevance of risk information exhibits cross-sectional variations conditional on firms' growth and profitability. In particular, we find an asymmetric response of stock prices to upside- and downside-risk disclosures for high-growth firms but not those with low growth. In addition, profit-making firms, but not loss-making firms, provide upside and downside disclosures that significantly influence stock prices.

Our results have theoretical and practical implications. Theoretically, our findings emphasize the importance of distinguishing the tone of disclosure when studying the impact on the market. Practically, our results show that the annual report still carries value that is relevant to investors. Furthermore, our study has broad implications for investors and policy makers. Investors should take risk information into account to ensure that they make the right investment decisions. Lastly, given the valuation importance of risk information, policy makers should take effective measures to improve the informativeness of risk disclosure by reviewing risk regulations in order to ensure the quality of such disclosure.

We contribute to the extant research on value relevance and risk reporting by providing new evidence on the extent to which, and how, combining the accounting numbers examined extensively in prior research with non-accounting information (i.e., risk information) is important for observing value relevance. Our paper also advances prior research on the usefulness of risk disclosure by looking at the tone of this information and how the market responds to each type of disclosure. By doing so, we respond to Kravet and Muslu's (2013) suggestion that future research look at the tone or the severity of textual risk disclosures. Our paper answers Lyle et al.'s (2013) call for empirical research to consider the incremental value of nonfinancial disclosure while observing the value relevance of accounting information. This combination of risk reporting is particularly important because looking at the impact of earnings on the return or market value without considering the riskiness of the firm, captured by risk-related disclosures, contradicts the view of the necessity of matching returns with associated risks.

Our paper is structured as follows. Section 2 discusses relevant theoretical underpinnings and develops research hypotheses. Section 3 provides the research methods. Empirical results and further analyses are discussed in Section 4. Section 5 concludes, provides implications, and suggests avenues for future research.

2. Theoretical underpinnings, relevant literature, and hypothesis development

2.1. Theoretical underpinnings

The proprietary costs theory (Verrecchia, 1990) suggests that firms might not fully reveal information due to related costs (i.e., the preparation, dissemination, and most importantly, the consequences of disclosure). This theory suggests that firms are likely to provide information similar to that provided by other firms and that firms are unlikely to provide useful information. However, they should revise their disclosures regularly in response to any changes that lead to different levels of risk exposure.

More recently, the Institute of Chartered Accountants in England and Wales (ICAEW) (2011) argues that, even under the assumption that firms provide risk information that is more generic (boilerplate) than firm specific, there will be two competing hypotheses. The first reflects the fact that this generic information might allow investors to draw conclusions about managers' perceptions and priorities, and the second contends that this kind of information could prompt investors to draw incorrect conclusions (e.g., that managers ignore risks that they do not report). Managers who are concerned about this possibility are likely to disclose all potential risks, even though doing so adds to the volume of boilerplate information revealed. It is further argued that firms with similar business

[1] UK reporting outlets are different from those in the US. In the US, most of the textual research is based on 10-K filings, which can be accessed easily on the Securities and Exchange Commission's (SEC) EDGAR system. These filings have a standard template with several sections (items) where firms provide information on aspects of their business. In contrast, most textual research in the UK has been conducted using annual reports that are not standardized, as the UK has no regulations that stipulate the order of the sections in which information is provided, the formatting of the information, or the mandatory and voluntary sections of the annual report.

models are still likely to report their risk differently, because they identify different aspects as essential to announce to investors so as to inform them about the risk process (identify, measure, and disclose).

2.2. Relevant literature and hypothesis development

2.2.1. The value relevance of aggregate risk disclosure

Risk information plays an essential role in this process, as it can affect the discount rate used to discount future cash flows. If investors have major concerns about a company (e.g., cash flows, dividends), this might increase the uncertainty they face. A high level of uncertainty about a company's investment could lead existing and potential investors to require a high rate of return to compensate them for the inherently high risk, suggesting a direct impact on security valuation. If the firm reacts to the increased level of risk by adopting effective risk management strategies, then revealing information about how it handles the risk could be essential for reducing the uncertainty for investors.

This argument is consistent with Jorgensen and Kirschenheiter's (2003) theoretical model, which implies that stock price movements are influenced by market-wide, rather than firm-specific risk, as proxied by the variance in a firm's future cash flows. They explain that, in a voluntary risk disclosure regime, firms have higher stock prices if their managers disclose information about risk than if they do not. Furthermore, according to their analyses, imposing risk disclosure lowers share prices compared with a discretionary disclosure regime.

Among risk-reporting studies, Kravet and Muslu (2013) find that an annual increase in the number of risk sentences in a company's 10-K filing is associated with higher return volatility (particularly, higher volatility of negative returns) and a higher trading volume during the 60 trading days after filing relative to before the filing, a higher three-day trading volume around the filing, and more volatile analyst forecast revisions around the filing. They find that annual increases in risk disclosure are associated with increased stock return volatility and trading volumes around and after the filings, and with more dispersed forecast revisions around the filings. They find that changes in risk disclosure are likely to be significantly associated with changes in trading volume. The findings therefore suggest that an increase in risk disclosure reduces the confidence of individual investors in their predictions, so they are more likely to trade when new information is disclosed. Based on this discussion on the theory and prior research, we formulate the following hypothesis:

Hypothesis 1. *The level of aggregate risk information is negatively associated with stock prices.*

2.2.2. The value relevance of the tone in aggregate risk disclosure

In theory, managers are likely to decide whether to reveal relevant information only after assessing the value of signaling. Their final aim in doing so is to maximize the current wealth of the shareholders. Managers have incentives for voluntarily reporting positive information about their risks (reflecting potential gains and opportunities in general), as such information signals their strength to the market (e.g., Dye, 2001). Suijs (2011) theorizes that, although the content of news (good or bad) determines the current stock return, the informativeness of this news affects the future expected stock return, as informative news reduces investment risk to a larger extent. In particular, good news results in a positive return over the pre-disclosure level, whereas highly informative good news suggests a low expected return over the post-disclosure period.

Kothari et al. (2009) argue that looking at the content of disclosure (i.e., whether it conveys good/favorable or bad/unfavorable news), rather than the level (i.e., the amount) of disclosure, is essential for observing the impact on market indicators. Kothari et al. (2009) find that, although positive news decreases firms' riskiness, negative news increases firms' riskiness. However, after considering corporate annual reports, Kothari et al. (2009) do not find an impact of good news on market indicators. They claim that this result is likely to be related to the problem of quantifying the tone of annual reports based on General Inquirer software. This conclusion is in line with the findings of Loughran and McDonald (2011).

In addition, Schleicher (2012) relies on manual content analysis, reading the last section (the outlook section) of the chairman's statement and then identifying whether each statement conveys positive, neutral, or negative news. He finds that firms with a large impending decline in performance bias the tone in the outlook section upward by using more positive than negative statements. He also finds that loss-making and risky firms provide more positive information, but firms with a decline in earnings provide more bad news.

This discussion leads us to predict that the market is likely to react differently to upside- and downside-risk disclosure, and the former (latter) tends to increase (decrease) stock prices. We therefore formulate the following hypothesis:

Hypothesis 2. *The market is likely to incorporate the tone (upside/downside) of aggregate risk information into stock prices differently.*

3. Research design

3.1. Sample and data

Our starting point is to generate a list of the FTSE All-Share nonfinancial firms from Thomson One. This list comprises 3051 firm-year observations of nonfinancial and publicly listed firms from the period 2005−2013.[2] We exclude

[2] Gilbert and Strugnell (2010) argue that excluding delisted/failed firms might skew the distribution of the stock price, return, or market value (the main indicators for the value relevance of risk information); they find, however, that this exclusion might not materially affect the empirical results and thus the final conclusion. Consistent with their findings, our main conclusion remains qualitatively unchanged after considering various changes in the current research design that affect the sample size (discussed in Section 4.4.1).

financial firms as they have different characteristics from other firms and distinct regulations (e.g., Elshandidy et al., 2013; Elshandidy et al., 2015). Our sample period starts in 2005, when adopting International Financial Reporting Standards (IFRS) became mandatory for UK firms, which allows us to isolate any regulatory changes in risk reporting. Our period ends in 2013, allowing us to maintain consistency in the content of the narrative sections of the annual reports, which are different from those provided in the integrated and strategic reports that UK firms started to produce voluntarily beginning in 2014.

As far as the textual analysis for risk-related disclosure is concerned, we rely on the content of annual reports to quantify their narrative sections. The annual reports of the UK firms are collected from either Thomson One or the company's website. Our study focuses on annual reports because they remain a primary source of information for investors, unlike other forms, such as interim reports. Annual reports are increasingly used, indicating their value relevance to investors (e.g., Beattie, 2014). All annual reports are converted into text files so as to be readable by QSR version 6. Therefore, annual reports that cannot be converted into text files or can be converted but cannot be processed by the software are excluded—a total of 486 firm-year observations. Furthermore, any firm without both annual reports and market data is omitted, bringing the total to 624 firm-year observations. Consequently, the total size of the sample is 1941 firm-years.

3.2. Measuring risk-related disclosure

3.2.1. Aggregate risk disclosure

Our paper uses QSR version 6 to measure the frequency of sentences indicating risk in the narrative sections of annual reports. The aggregate risk disclosure score is calculated as the proportion of sentences in an annual report that indicate risk (i.e., the number indicating risk divided by the total number). To enable the software to capture the risk-indicative sentences, it is necessary to generate a word list of risk-related words. To that end, the paper adopts a concept of risk that encompasses both the downside (i.e., losses, threats, and dangers) and the upside (i.e., gains and opportunities) of risk. This approach is largely consistent with the academic literature (e.g., Elshandidy, 2011) and professional initiatives (e.g., ICAEW, 2011) on risk reporting. Consistent with the approaches used by Kravet and Muslu (2013) and Elshandidy and Neri (2015), our word list contains the following words: risk*, loss*, decline (declined), decrease (decreased), less than, lower than, fail (failed, failure), threat, reverse (reversed), against, catastrophe (catastrophic), shortage, unable, challenge (challenged, challenges), uncertain (uncertainty, uncertainties), gain (gains), chance (chances), increase (increased), peak (peaked), higher (higher than, highest), more than, hedge (hedging), fluctuate*, differ*, diversify*, probable*, significant*, affect, potential*, depend*, expose*, vary (varies), likely to, might, influence (influenced), susceptible, viable. For words followed by *, we also include derivatives of them. Thus, any sentence that contains at least one of the words counts toward the aggregate risk disclosure score, which is then scaled by the total number of sentences coded for the entire annual report.

3.2.2. The tone of the aggregate risk disclosure: downside- (negative) and upside- (positive) risk disclosure

As our list adopts words for capturing both the downside and the upside of risk, we can identify whether each risk statement that counts toward our aggregate risk score has a negative (related to the downside) or positive (related to the upside) tone. Based on our final list, we identify negative risk disclosure scores (downside) by counting the number of risk sentences that contain at least one of the following words: against, catastrophe (catastrophic), challenge (challenges), decline (declined), decrease (decreased), fail (failure), less, loss (losses), low*, risk*, shortage, threat, unable, uncertain (uncertainty, uncertainties), reverse (reversed). Similarly, positive risk disclosure scores (upside) are identified by counting the number of risk sentences that contain at least one of the following words: hedge (hedging), chance (chances), diversify*, gain (gains), increase (increased), peak (peaked), high (highest, higher than). For words followed by *, we also include derivatives of the original.[3]

We also consider situations in which there might be a possibility of misclassification of upside or downside. In particular, when the business context is considered, words such as increase (higher and/or more than) or decrease (lower and/or less than) might not reflect good or bad news, respectively. For example, the combination of the previous words with expense, cost, loss, risk, or uncertainty would have different meanings. Another, but related, point is that using words such as “not,” “no,” or “stop” might also change the meaning. We account for such occurrences when scoring upside- and downside-risk disclosure. Fig. 1 summarizes the textual analysis steps used to capture risk-related disclosure.[4]

3.3. Value-relevance model

$$P_{it+1} = \alpha_0 + \alpha_1 BVPS_{it} + \alpha_2 EPS_{it} + \sum_{i=1}^{216} Firm_{il} + \sum_{l=1}^{9} Year_{il} + \varepsilon_{it} \quad (1)$$

To assess whether risk-related disclosure reflects information used by investors in valuing firm equity, we estimate the following model based on Ohlson's (1995) framework. This approach has been applied extensively in prior empirical

[3] We exclude neutral words (namely, fluctuate, differ, probable, possible, affect, vary, varies, likely to, might, influence (influenced), susceptible, and viable) that indicate change or volatility, counting them in our aggregate scores, but not using them to indicate a positive or negative tone.

[4] We confirmed our calculated scores for risk-related disclosure (aggregate-, upside-, and downside-risk disclosures along with net tone and neutral risk information) to ensure consistency in the calculations. Thus, we used Cronbach's alpha to examine the reliability of the scores for risk-related disclosure. Cronbach's alpha was 86%, indicating that consistency between the scores is high (Eshandidy, 2011).

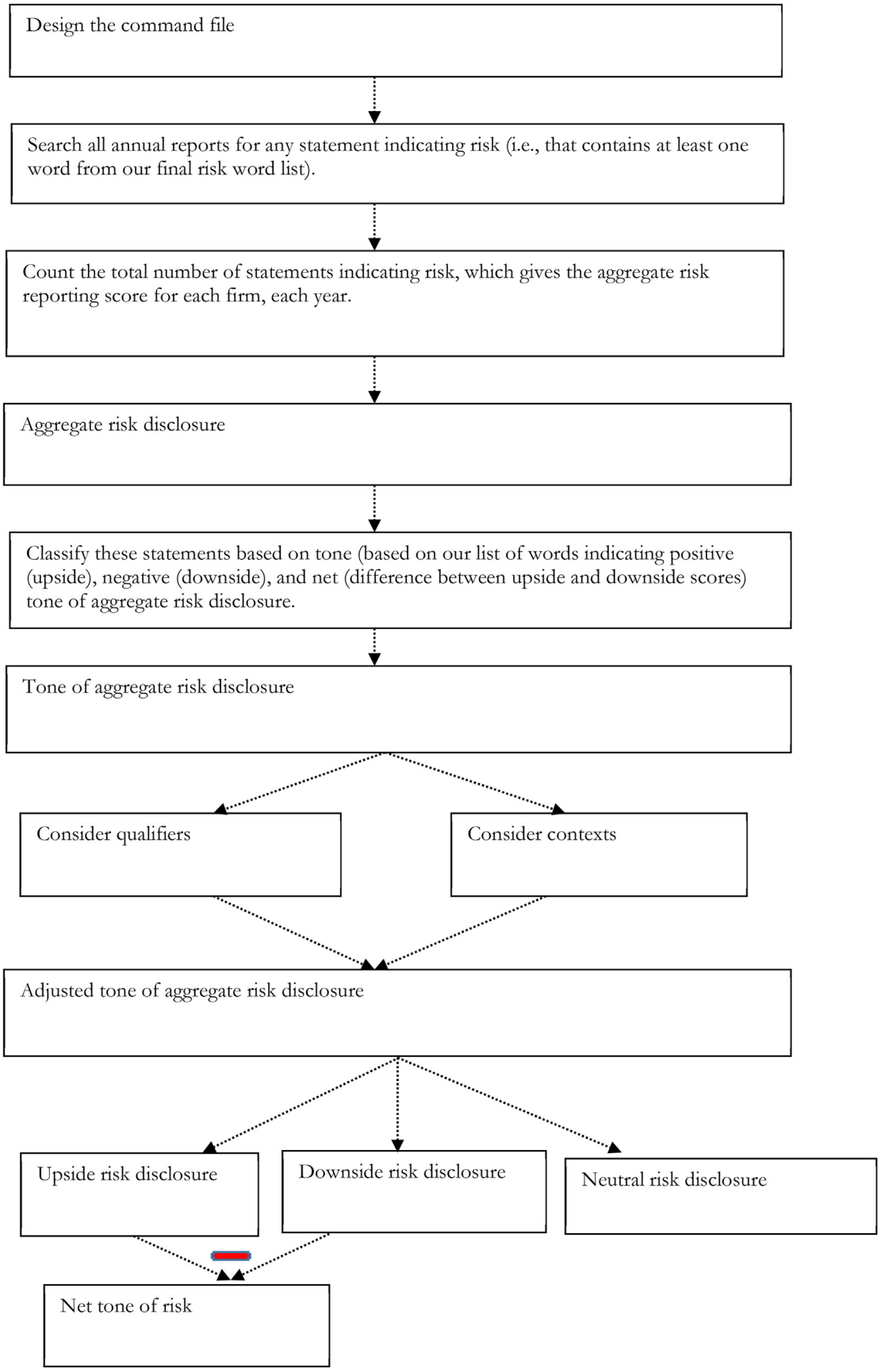


Fig. 1. Measuring risk-related disclosure using textual analysis This figure describes the main steps taken to generate risk-related disclosure scores (aggregate and its tone).

studies on the value relevance of nonfinancial information (e.g., Johnston et al., 2008; Rajgopal et al., 2003; Schadewitz & Niskala, 2010; Sinkin et al., 2008). Our baseline model suggests that the stock price is a function of two summary measures of accounting information, namely, the book value of equity and earnings.

Together with the extent of risk-related information (aggregate, upside, downside, and net risk disclosure), which is our key variable of interest. The following equation tests H1, which concerns aggregate risk disclosure:

$$P_{it+1} = \alpha_0 + \alpha_1 BVPS_{it} + \alpha_2 EPS_{it} + \alpha_3 AGRISKD_{it} + \sum_{i=1}^{216} Firm_{it} + \sum_{t=1}^{9} Year_{it} + \varepsilon_{it} \quad (2)$$

where, for firm i and year t, P is the average stock price over a three-month period after the annual reports become available. *BVPS* is the book value per share, and *EPS* is the net income per share. *AGRISKD* is the level of aggregate risk-related disclosure, explained in Section 3.2.1. We include year dummy variables to control for year-specific shocks. Also, we include firm fixed effects to control for unobservable firm characteristics that may affect the stock price and risk disclosure simultaneously. The response coefficients, $\alpha 1$, $\alpha 2$, and $\alpha 3$, capture the sensitivity of the share price to the book value per share, earnings per share, and risk disclosure, respectively. In particular, if aggregate risk information increases (decreases) the discount rate in the valuation model, leading to a lower (higher) market value, then we would expect coefficient $\alpha 3$ to be significantly negative (positive).

Furthermore, we analyze whether and how investors perceive the tone of risk information by employing the following equation, which tests H2:

$$P_{it+1} = \alpha_0 + \alpha_1 BVPS_{it} + \alpha_2 EPS_{it} + \alpha_3 UPRISKD_{it} + \alpha_4 DNRISKD_{it} + \sum_{i=1}^{216} Firm_{it} + \sum_{t=1}^{9} Year_{it} + \varepsilon_{it} \quad (3)$$

where *UPRISK* and *DNRISK* represent risk disclosure with favorable and unfavorable tone, respectively. Details of the variable definitions are in Section 3.2.2. If stock prices react positively (negatively) to good (bad) news, as predicted in H2, then the coefficient α_3 (α_4) should be significantly positive (negative). In both equations, we use firm fixed effects to eliminate the effects of time-invariant characteristics from the regressor variables.

In two further models, we introduce two other variables related to risk disclosure. The first captures the net tone of risk disclosure, which is measured as the difference between upside- and downside-risk disclosure, for firm i and year t. Additionally, we introduce neutral risk information, which captures the moderate tone of risk information (sentences that give neither a positive nor a negative signal), measured as the aggregate risk information minus the sum of the upside- and downside-risk information, for firm i and year t.

$$P_{it+1} = \alpha_0 + \alpha_1 BVPS_{it} + \alpha_2 EPS_{it} + \alpha_3 NTRISK_{it} + \sum_{i=1}^{216} Firm_{it} + \sum_{t=1}^{9} Year_{it} + \varepsilon_{it} \quad (4)$$

$$P_{it+1} = \alpha_0 + \alpha_1 BVPS_{it} + \alpha_2 EPS_{it} + \alpha_3 NURISKD_{it} + \sum_{i=1}^{216} Firm_{it} + \sum_{t=1}^{9} Year_{it} + \varepsilon_{it} \quad (5)$$

4. Empirical findings

4.1. Descriptive statistics and correlation matrix

Table 1, which lists the descriptive statistics, shows a large variance in earnings per share, ranging from 0 to 184.32. The results also show that the average price is 5.26, with a standard deviation of around 6. The results also show that UK nonfinancial firms tend to spend about 17 percent, on average, of their narratives on risk information. Also, the level of risk disclosure, unreported, varies dramatically among firms. For example, the minimum proportion of risk information provided by a firm is 0.06 percent, whereas the maximum proportion revealed is 27.07 percent. Of this risk information, 5.71 percent, on average, is information related to upside risk (positive tone), and about 8.12 percent, on average, is information related to downside risk (negative tone). The net tone (difference between upside- and downside-risk disclosure) indicates that, on average, UK firms reveal more information with a negative than a positive tone.

Panel B of Table 1 gives descriptive statistics on some variables that we use to conduct further analysis, including growth and profitability. The relevance of risk information might vary between high-growth and loss-making versus low-growth and profit-making firms.

Panel C of Table 1 gives descriptive statistics on some variables that we use to validate our findings, including alternative measures for the main dependent variable (the stock price) through the inclusion of Tobin's Q and for the main independent variables (tone of risk disclosure) through the inclusion of Loughran and McDonald's measures for good and bad news (e.g., Ahmed & Elshandidy, 2016) for the entire annual report, rather the tone of risk disclosure.

Table 2 shows a Pearson correlation matrix for all variables. Broadly consistent with our predictions, stock prices are significantly and positively correlated with the book value per share and earnings per share, which suggests that accounting numbers are value relevant, as they influence investors' price

Table 1
Descriptive statistics.

Variable	Observations	Mean	Std. Dev.	25%	Median	75%
*Panel A: Variables used in the main analyses*rowhead						
P_{it+1}	1941	5.26	5.90	1.57	3.15	6.41
$BVPS_{it}$	1941	2.13	2.58	0.66	1.30	2.57
EPS_{it}	1941	34.49	38.59	9.92	22.80	42.2
$AGRISKD_{it}$	1941	17.11	4.19	15.34	17.87	20.01
$UPRISKD_{it}$	1941	5.71	2.15	4.57	5.77	7.01
$DNRISKD_{it}$	1941	8.12	2.62	6.90	8.31	9.66
$NTRISKD_{it}$	1941	−2.40	2.19	−3.70	−2.39	−0.90
$NURISKD_{it}$	1941	4.15	1.49	3.46	4.26	5.03
Panel B: Variables used in further analysisrowhead						
$GROWTH_{it}$	1941	2.88	5.07	1.40	2.26	3.70
$Profitability_{it}$	1941	23.21	37.34	8.92	17.06	26.25
Panel C: Variables used in robustness checksrowhead						
$Tobins'Q_{it+1}$	1820	1.10	0.85	0.56	0.87	1.36
R_{it+1}	1941	0.1065	17.73	−8.88	−0.001	8.66
$LM\ positive_{it+1}$	1858	0.98	0.48	0.73	0.92	1.11
$LM\ negative_{it+1}$	1858	0.93	0.50	0.69	0.85	1.04

Notes: This table presents summary statistics of variables used in the main analyses (Panel A), in further analyses (Panel B), and in robustness checks (Panel C). Variable definitions, measures, and sources are detailed in Appendix 1. All variables are winsorized at the 1% and 99% levels.

decisions. With regard to risk-related disclosures, although we do not observe any significant influence by either the aggregate or the neutral risk disclosures, we do observe a significantly positive (negative) impact of the upside- and the net-(downside-) risk disclosures. This result suggests that the aggregate risk disclosure has only a moderate effect on the stock price, whereas the neutral risk disclosure is not associated with the stock price. However, the tone of the disclosure seems to significantly affect stock prices. These results lend initial support to our hypotheses.

4.2. Test of H1 and H2

Table 3 presents the regression results obtained from testing H1 and H2. Column (1) reports the results of the baseline model, which suggest that both book value (coefficient = 0.732, $p = 0.000$) and earnings (coefficient = 0.056, $p = 0.000$) are value relevant to investors. In column (2), where risk disclosure is included as an independent variable, the coefficient on *RISKD* is negative but insignificant (coefficient = −0.016, $p = 0.175$). This result suggests that risk information as a whole does not affect stock prices because managers might provide this kind of information as a boilerplate, consistent with the notion of prior empirical research (Campbell et al., 2014; Kravet & Muslu, 2013) that risk disclosure (especially in the aggregate) is not particularly useful for investors.

Column (3) presents the regression results obtained in testing H2. The coefficient on *UPRISK* (i.e., upside-risk disclosure or favorable/good news) is positive (coefficient = 0.131, $p = 0.001$), while that on *DNRISK* (i.e., downside-risk disclosure or unfavorable/bad news) is significantly negative (coefficient = −0.116, $p = 0.000$), consistent with Kothari et al. (2009), who find that good (bad) news decreases (increases) the risk to expected cash flows and causes investors to require a lower (higher) discount rate. The effect of good and bad news about risk is economically large, as a one-standard-deviation increase in upside-risk disclosure (2.15) is associated with a 28.17-percentage-point increase in stock prices. A one-standard-deviation (2.62) increase in downside-risk disclosure, however, is associated with a 30.40-percentage-point decrease in stock prices. The effect of downside-risk disclosure seems to be higher than the effect of upside-risk disclosure on stock prices. These results generally suggest that investors are likely to respond more strongly to a negative tone than a positive tone, because of the higher information content in the former than the latter. Our findings are consistent with the theoretical explanations of Suijs (2011) and the empirical findings of Bird et al. (2014).

The direction of the effects suggests that the release of upside-risk disclosure reveals known risk factors to investors, while the release of downside-risk disclosure reveals unknown risk factors to investors. Specifically, the downside-risk information revealed tends to indicate unknown risk factors and increase investors' concerns about uncertainty and risks that firms might encounter in their future operations. This raises the rate of return required to compensate those investors for the risk and thereby decrease stock prices, cash flows being constant. The upside-risk disclosure revealed tends to indicate known risk factors and decrease investors' concerns about related uncertainty. This result is consistent with the empirical findings of Kothari et al. (2009) and Elshandidy and Shrives (2016).

This is corroborated by the results in column (4), in which the variable of interest is net favorable news (*NTRISK*). A higher value of *NTRISK* indicates a more positive than negative tone and less uncertainty facing investors. In line with this, we find that the coefficient on *NTRISK* is significantly positive (coefficient = 0.134, $p = 0.000$).

When neutral risk information (information that does not indicate either good or bad news) is introduced in column (5), we do not observe any impact of this information on stock prices, suggesting that investors do not react to this information, as it does not contain any reflection of the tone of the risk information. These findings are consistent with theoretical arguments of Kothari et al. (2009) as well as the empirical findings of Elshandidy and Shrives (2016).

4.3. Cross-sectional variation analyses

This subsection investigates whether the relations documented above are conditional on firm characteristics (i.e., growth opportunities and profitability status) and a macro-economic shock (i.e., the global financial crisis).

We first compare the main variables between firms with different growth opportunities and profitability status. High-growth (e.g., Skinner & Sloan, 2002) and loss-making (Schleicher et al., 2007) firms are expected to behave differently in revealing risk information, resulting in different impacts on stock prices.

Panel A of Table 4 compares the means of variables between high- and low-growth firms, for which growth is

Table 2
Correlation matrix.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
P_{it+1}	**(1)**	1.000							
$BVPS_{it}$	**(2)**	0.676***	1.000						
		(0.000)							
EPS_{it}	**(3)**	0.703***	0.472***	1.000					
		(0.000)	(0.000)						
$AGRISKD_{it}$	**(4)**	−0.025	−0.007	−0.056**	1.000				
		(0.269)	(0.731)	(0.013)					
$UPRISKD_{it}$	**(5)**	0.074***	0.075***	−0.015	0.777***	1.000			
		(0.001)	(0.000)	(0.502)	(0.000)				
$DNRISKD_{it}$	**(6)**	−0.091***	−0.071***	−0.075***	0.864***	0.539***	1.000		
		(0.000)	(0.001)	(0.000)	(0.000)	(0.000)			
$NTRISKD_{it}$	**(7)**	0.174***	0.148***	0.076***	−0.269***	0.298***	−0.631***	1.000	
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
$NURISKD_{it}$	**(8)**	0.015	0.010	0.005	0.801***	0.545***	0.686***	−0.296***	1.000
		(0.483)	(0.657)	(0.815)	(0.000)	(0.000)	(0.000)	(0.000)	

Notes: This table presents a correlation matrix of variables used in our analyses. Variable definitions, measures, and sources are detailed in Appendix 1. All variables are winsorized at the 1% and 99% levels. The values in parenthesis are p-values. ***, **, and * indicate significance at 1%, 5%, and 10%, based on a two-tailed *t*-test.

Table 3
Value relevance of risk-related disclosure.

Independent variables	ES	Dependent variable = P_{t+1}				
		(1)	(2)	(3)	(4)	(5)
$BVPS_{it}$	(+)	0.732***	0.734***	0.721***	0.721***	0.732***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EPS_{it}	(+)	0.056***	0.056***	0.055***	0.055***	0.056***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$AGRISKD_{it}$	(−)		−0.016			
			(0.175)			
$UPRISKD_{it}$	(+)			0.131***		
				(0.001)		
$DNRISKD_{it}$	(−)			−0.116***		
				(0.000)		
$NTRISKD_{it}$	(+)				0.134***	
					(0.000)	
$NURISKD_{it}$	(?)					−0.035
						(0.397)
Intercept	(?)	3.138***	3.446***	3.584***	3.723***	3.302***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year FE		Included	Included	Included	Included	Included
Firm FE		Included	Included	Included	Included	Included
Observations		1941	1941	1941	1941	1941
R-squared		0.402	0.403	0.408	0.408	0.402

Notes: This table presents the results of the fixed effects panel regressions for the value relevance of risk information. Variable definitions, measures, and sources are detailed in Appendix 1. ES indicates the expected sign (i.e., direction). All variables are winsorized at the 1% and 99% levels. The values in parenthesis are t-values. ***, **, and * indicate significance at 1%, 5%, and 10%, based on a two-tailed *t*-test.

measured by the market-to-book value (MTBV). A firm is classified as high-growth if its MTBV is above the sample median. The results suggest that high-growth firms tend to disclose more (less) upside (downside) risks, which is broadly consistent with prior evidence (e.g., Skinner & Sloan, 2002). The results also document significant differences between these two groups of firms in terms of upside-risk disclosure, downside-risk disclosure, and net tone, with t-statistics of −2.856, 3.231, and 5.655, respectively. Panel B of Table 4 compares the means of the variables between loss- and profit-making firms, where firms are classified as loss-making if the value of the return on equity (ROE) is negative for firm *i* in year *t*. We find that loss-making firms release higher (less) levels of aggregate risk disclosure, downside-risk disclosure, and net tone (upside-risk disclosure) than profit-making firms, with *t*-statistics of 1.680, 5.257, and 9.403 (−2.997), respectively.

4.3.1. Value relevance of risk-related disclosures conditioned by growth opportunities

This section examines the impact of growth opportunities on the value relevance of risk-related disclosures by dividing our full sample into high- and low-growth firms based on the market-to-book ratio. Columns (1) and (2) of Table 5 suggest

that accounting information is value relevant, and investors price this information regardless of firms' growth opportunities.

However, risk-related information has different influencing roles, conditional on firms' growth opportunities. Specifically, as seen in columns (3) and (4) of Table 5, aggregate risk disclosure is insignificant, but it is negatively priced for both high- and low-growth firms. In column (5), we find a significantly asymmetric response of stock prices to upside- and downside-risk disclosure for high-growth firms, with coefficients of 0.152 and −0.170 at *p*-values of 0.010 and 0.000, respectively. In column (6), the market prices both upside- and downside-risk disclosures considerably, as the coefficients on these two variables are 0.126 and −0.078 at *p*-values of 0.007 and 0.026, respectively. Overall, we find that high-growth firms outperform (underperform) low-growth firms when the information is encouraging (disappointing).

4.3.2. Value relevance of risk-related disclosures conditioned by profitability status

Table 6 presents regression results used to compare the value relevance between profit-making and loss-making firms.

Table 4
Univariate analyses.

Panel A: Differences between low- and high-growth firms					
Variable	Low-growth firms		High-growth firms		Differences (Low-High)
	Observations	Mean	Observations	Mean	(t-statistics)
P_{it+1}	979	3.83	962	6.72	−2.902*** (−11.175)
$BVPS_{it}$	979	2.55	962	1.71	0.838*** (7.233)
EPS_{it}	979	28.35	962	40.73	−12.370*** (−7.152)
$AGRISKD_{it}$	979	17.14	962	17.08	0.404 (0.270)
$UPRISKD_{it}$	979	5.60	962	5.83	−0.226*** (−2.856)
$DNRISKD_{it}$	979	8.27	962	7.96	0.317*** (3.231)
$NTRISKD_{it}$	979	−2.67	962	−2.11	−0.560*** (5.655)
$NURISKD_{it}$	979	4.15	962	4.14	0.007 (0.108)
Panel B: Differences between loss- and profit-making firms					
Variable	Loss-making firms		Profit-making firms		Differences (Loss-Profit)
	Observations	Mean	Observations	Mean	(t-statistics)
P_{it+1}	182	2.31	1759	5.56	−3.262*** (−7.193)
$BVPS_{it}$	182	1.698	1759	2.183	−0.484** (−2.408)
EPS_{it}	182	16.44	1759	36.35	−19.909*** (−6.698)
$AGRISKD_{it}$	182	17.69	1759	17.05	0.643* (1.680)
$UPRISKD_{it}$	182	5.26	1759	5.76	−0.502*** (−2.997)
$DNRISKD_{it}$	182	9.08	1759	8.02	1.077*** (5.257)
$NTRISKD_{it}$	182	−3.82	1759	−2.25	−1.575*** (−9.403)
$NURISKD_{it}$	182	4.28	1759	4.14	0.149 (1.286)

Notes: This table presents univariate analyses. Panel A compares the means of variables between high- and low-growth firms, where growth is measured by the market-to-book ratio (M/B). A firm is classified as a high-growth firm if its M/B is above the median. Panel B compares the means of variables between loss-making and profit-making firms. Firms are classified as loss making if the value of ROE is negative for firm i in year t. Variable definitions, measures, and sources are detailed in Appendix 1. All variables are winsorized at the 1% and 99% levels. ***, **, and * indicate significance at 1%, 5%, and 10%, based on a two-tailed *t*-test.

Table 5
Value relevance of risk-related disclosure conditional on firms' growth opportunities.

Independent variables	ES	Dependent variable = P_{t+1}									
		Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)	Model (9)	Model (10)
		High-growth	Low-growth	High-growth	Low-growth	High-growth	Low-growth	High-growth	Low-growth	High-growth	Low-growth
$BVPS_{it}$	(+)	0.953***	1.016***	0.959***	1.021***	0.922***	1.008***	0.924***	1.011***	0.953***	1.015***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EPS_{it}	(+)	0.069***	0.017***	0.069***	0.017***	0.070***	0.017***	0.070***	0.017***	0.069***	0.018***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$AGRISKD_{it}$	(−)			−0.021	−0.013						
				(0.230)	(0.392)						
$UPRISKD_{it}$	(+)					0.152***	0.126***				
						(0.010)	(0.007)				
$DNRISKD_{it}$	(−)					−0.170***	−0.078**				
						(0.000)	(0.026)				
$NTRISKD_{it}$	(+)							0.183***	0.085**		
								(0.000)	(0.021)		
$NURISKD_{it}$	(?)									−0.065	0.023
										(0.298)	(0.654)
Intercept	(?)	3.846***	1.224***	4.254***	1.464***	4.636***	1.330***	4.544***	1.607***	4.156***	1.122***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Year FE		Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Firm FE		Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Observations		962	979	962	979	962	979	962	979	962	979
R-squared		0.518	0.392	0.519	0.392	0.526	0.398	0.526	0.396	0.519	0.392

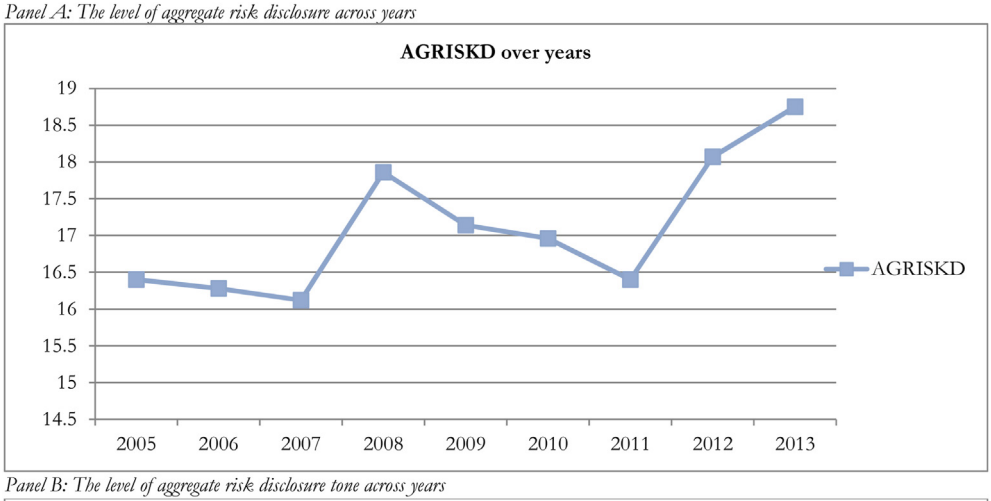
Notes: This table presents the results of the fixed effects panel regressions for the value relevance of risk information conditional on firms' growth opportunities. A firm is classified as a high-growth firm if its market-to-book ratio is above the median. Variable definitions, measures, and sources are detailed in Appendix 1. ES indicates the expected sign (i.e., direction). All variables are winsorized at the 1% and 99% levels. The values in parenthesis are t-values. ***, **, and * indicate significance at 1%, 5%, and 10%, based on a two-tailed *t*-test.

Table 6
Value relevance of risk-related disclosure conditional on firms' profitability.

Independent variables	ES	Dependent variable = P_{t+1}									
		Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)	Model (9)	Model (10)
		Profit-making	Loss-making	Profit-making	Loss-making	Profit-making	Loss-making	Profit-making	Loss-making	Profit-making	Loss-making
$BVPS_{it}$	(+)	0.630***	1.744***	0.631***	1.749***	0.618***	1.743***	0.618***	1.754***	0.630***	1.743***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EPS_{it}	(+)	0.061***	−0.044***	0.061***	−0.044***	0.061***	−0.044***	0.061***	−0.044***	0.061***	−0.044***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$AGRISKD_{it}$	(−)			−0.017	0.033						
				(0.173)	(0.425)						
$UPRISKD_{it}$	(+)					0.127***	0.034				
						(0.001)	(0.823)				
$DNRISKD_{it}$	(−)					−0.116***	0.042				
						(0.000)	(0.671)				
$NTRISKD_{it}$	(+)							0.134***	−0.041		
								(0.000)	(0.674)		
$NURISKD_{it}$	(?)									−0.046	0.105
										(0.289)	(0.502)
Intercept	(?)	3.575***	1.319***	3.901***	0.721	4.012***	0.760	4.125***	1.084	3.786***	0.822
		(0.000)	(0.006)	(0.000)	(0.416)	(0.000)	(0.391)	(0.000)	(0.142)	(0.000)	(0.350)
Year FE		Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Firm FE		Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Observations		1759	182	1759	182	1759	182	1759	182	1759	182
R-squared		0.423	0.859	0.424	0.860	0.429	0.860	0.429	0.859	0.423	0.860

Notes: This table presents the results of the fixed effects panel regressions for the value relevance of risk information conditional on firms' profitability. A firm is classified as a profit-making firm if its ROE is positive. Variable definitions, measures, and sources are detailed in Appendix 1. ES indicates the expected sign (i.e., direction). All variables are winsorized at the 1% and 99% levels. The values in parenthesis are t-values. ***, **, and * indicate significance at 1%, 5%, and 10%, based on a two-tailed *t*-test.

Panel A: The level of aggregate risk disclosure across years



Panel B: The level of aggregate risk disclosure tone across years

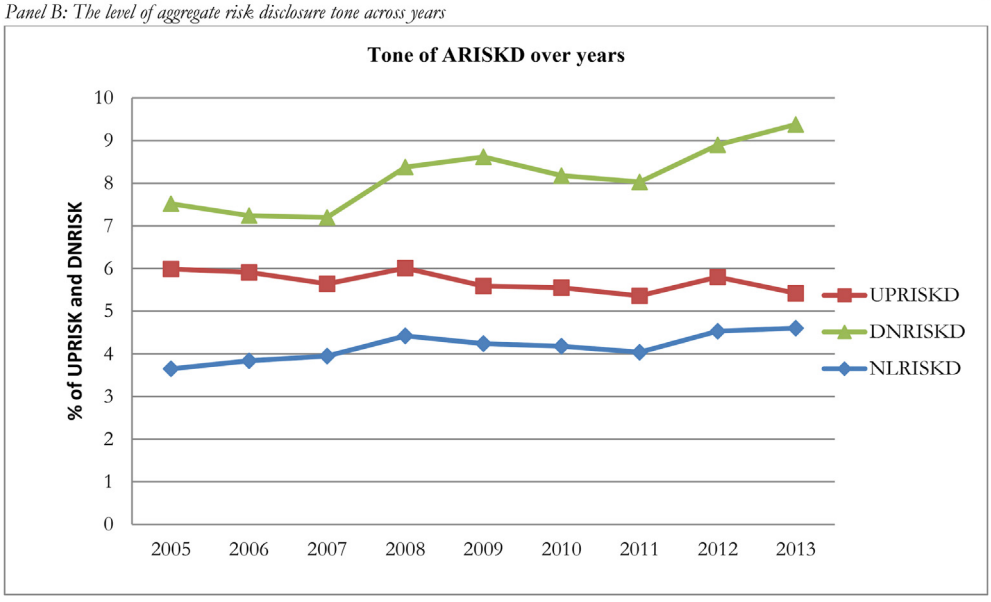


Fig. 2. The level of risk-related disclosure across years. This figure gives the average of aggregate risk disclosure and its tone over the study period.

We find that, in columns (1) and (2), accounting information significantly influences stock prices for both profit-making and loss-making firms.

When the aggregate risk information is introduced for both groups of firms, in columns (3) and (4), we find nonsignificant effects on prices for both loss-making and profit-making firms. The tone of the risk information is introduced for both groups of firms in columns (5) and (6), where the results suggest that the stock prices are significantly sensitive to the tone for profit-making firms but not for loss-making firms. We find that the prices are significantly and positively influenced by upside-risk disclosure, with a coefficient of 0.127 at a *p*-value of 0.001. The influence of downside-risk disclosure on prices is negative, however, with a coefficient of −0.116 at a *p*-value of 0.000. Furthermore, we still observe the same pattern of associations when the net effect of the tone of risk disclosure is introduced for both groups of firms, in columns (7) and (8). After the introduction of the neutral component of risk information in columns (9) and (10), the results still support our previous findings: prices do not react to this neutral tone of risk information for either group of firms.

Collectively, our evidence suggests that the value relevance of accounting information combined with soft information (risk-related disclosures) differs between these two groups of firms based on their profitability status. In general, our conclusion supports the notion that risk disclosure contains different information for these two groups of firms.

4.3.3. Value relevance of risk-related disclosures conditional on the global financial crisis

As shown in Fig. 2, since the financial crisis, risk disclosure has increased. We conduct further analysis by examining the role played by the financial crisis, which can be regarded as an unexpected economic shock, in the value relevance of risk information. Following previous studies (e.g., Elshandidy et al., 2015), we divide our sample period into subperiods for before (2005−2006), during (2007−2008), and after (2009−2013) the crisis.

Table 7
Value relevance of risk-related disclosure before, during and after the financial crisis.

Independent variables	ES	Dependent variable = P_{t+1}											
		Before the crisis (2005−2006)				During the crisis (2007−2008)				After the crisis (2009−2013)			
		Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)	Model (9)	Model (10)	Model (11)	Model (12)
$BVPS_{it}$	(+)	0.960***	0.941***	0.940***	0.961***	0.610***	0.550***	0.555***	0.612***	1.058***	1.029***	1.035***	1.060***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.005)	(0.004)	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)
EPS_{it}	(+)	0.080***	0.079***	0.079***	0.080***	0.041***	0.040***	0.039***	0.042***	0.083***	0.084***	0.083***	0.083***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.003)	(0.003)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)
$AGRISKD_{it}$	(−)	0.007				−0.024				0.026			
		(0.819)				(0.670)				(0.270)			
$UPRISKD_{it}$	(+)		0.220***				0.397***				0.211***		
			(0.002)				(0.005)				(0.002)		
$DNRISKD_{it}$	(−)		−0.164***				−0.313**				−0.108**		
			(0.006)				(0.011)				(0.029)		
$NTRISKD_{it}$	(+)			0.180***				0.333***				0.153***	
				(0.001)				(0.004)				(0.002)	
$NURISKD_{it}$	(?)				0.041				0.065				0.030
					(0.685)				(0.613)				(0.706)
Intercept	(?)	3.585***	3.485***	3.901***	3.541***	1.977	1.857	2.513**	1.101	−0.435	−0.184	0.550	−0.098
		(0.000)	(0.000)	(0.000)	(0.000)	(0.235)	(0.147)	(0.022)	(0.359)	(0.656)	(0.842)	(0.490)	(0.913)
Industry FE		Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Observations		702	702	702	702	245	245	245	245	994	994	994	994
Adjusted-R -squared		0.661	0.667	0.666	0.661	0.490	0.513	0.511	0.490	0.729	0.732	0.731	0.729

Notes: This table presents the OLS regression results for the value relevance of risk information before, during, and after the financial crisis. Variable definitions, measures, and sources are detailed in Appendix 1. ES indicates the expected sign (i.e., direction). All variables are winsorized at the 1% and 99% levels. The values in parenthesis are t-values. ***, **, and * indicate significance at 1%, 5%, and 10%, based on a two-tailed *t*-test.

Table 8
Value relevance of risk-related disclosure under different sample sizes.

Independent variables	ES	Dependent variable = P_{t+1}											
		Full sample				60% from full sample				80% from full sample			
		Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)	Model (9)	Model (10)	Model (11)	Model (12)
$BVPS_{it}$	(+)	0.734***	0.721***	0.721***	0.732***	0.760***	0.754***	0.753***	0.757***	0.790***	0.779***	0.778***	0.789***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EPS_{it}	(+)	0.056***	0.055***	0.055***	0.056***	0.050***	0.049***	0.049***	0.050***	0.052***	0.051***	0.051***	0.052***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$AGRISKD_{it}$	(−)	−0.016				−0.024				−0.020			
		(0.175)				(0.185)				(0.151)			
$UPRISKD_{it}$	(+)		0.131***				0.136**				0.135***		
			(0.001)				(0.013)				(0.002)		
$DNRISKD_{it}$	(−)		−0.116***				−0.128***				−0.125***		
			(0.000)				(0.004)				(0.000)		
$NTRISKD_{it}$	(+)			0.134***				0.140***				0.143***	
				(0.000)				(0.003)				(0.000)	
$NURISKD_{it}$	(?)				−0.035				−0.069				−0.055
					(0.397)				(0.271)				(0.259)
Intercept	(?)	3.446***	3.584***	3.723***	3.302***	3.937***	4.016***	4.101***	3.812***	3.446***	3.589***	3.701***	3.326***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year FE		Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Firm FE		Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Observations		1941	1941	1941	1941	1165	1165	1165	1165	1636	1636	1636	1636
R-squared		0.408	0.403	0.408	0.402	0.367	0.373	0.372	0.367	??	??	??	??

Notes: This table presents the results of the fixed effects panel regressions for the value relevance of risk information based on three sets of tests based on different sample sizes. The first set (Models 1−4) uses the entire sample, the second set (Models 5−8) uses 60% of the entire sample, and the third set (Models 9−12) uses 80% of the entire sample. Observations were randomly selected for the latter two sets from the first set. Variable definitions, measures, and sources are detailed in Appendix 1. **ES** indicates the expected sign (i.e., direction). All variables are winsorized at the 1% and 99% levels. The values in parenthesis are t-values. ***, **, and * indicate significance at 1%, 5%, and 10%, based on a two-tailed *t*-test.

The results are reported in Table 7, which gives the estimates based on ordinary least squares (OLS) regressions after controlling for industry fixed effects and correcting the standard errors for any heteroskedastic bias, following Campbell et al. (2014). The results show that, whereas the aggregate risk disclosure does not have an economic impact on stock prices over these three periods, the tone of the risk information has a significant impact that differs depending on the period of interest (before, during, and after the crisis). In particular, our results suggest that the impact of upside- (good news) risk disclosure is statistically observable in the three periods of interest (before, during, and after the crisis). Similarly, the downside-risk disclosure has a significantly negative impact on stock prices over these three periods. Generally, we find that positive news is positively valued (coefficient = 0.220, p = 0.002) and especially so during the crisis period (coefficient = 0.397, p = 0.005), when the market was filled with panic and investor confidence fell substantially. In contrast, downside-risk disclosure is negatively priced (coefficient = −0.164, p = 0.006), mostly during the crisis period, at which time market confidence was fragile and there was a high level of uncertainty (Bird et al., 2014). Furthermore, the relatively low adjusted R-squared during the crisis compared to those reported before and after the crisis reflects the difficulties in explaining variations in stock prices over the period of the crisis, since they fluctuated significantly, irrationally, and unexpectedly at that time.

4.4. Robustness checks

4.4.1. Findings' sensitivity to sample size

This subsection addresses the extent to which our empirical findings are sensitive to different sample sizes (different firm-year observations). Table 8 provides three sets of empirical results based on three different sample sizes. The first set (Models 1−4) restates our previous empirical results based on our full sample of 1941 firm-year observations. The second set (Models 5−8) reexamines the value relevance of risk information and its tone based on a randomly selected 60 percent of our entire sample. The third set (Models 9−12) does the same but with a randomly selected 80 percent of the full sample. Our results under these latter two sets (60 percent and 80 percent, respectively) of different sample sizes are similar, statistically and economically consistent with those reported for the first set (the full sample), suggesting that our conclusions in reported previous sections remain qualitatively unchanged with different sets of observations and further suggesting that our results can be generalized.

4.4.2. Tobin's Q instead of stock prices

As a robustness check, we replace the dependent variable of interest, stock prices, with Tobin's Q. We focus on Tobin's Q because it measures the excess market value of assets over their book value (Ayturk et al., 2016; Barth et al., 2017). Consistent with our previous findings, the unreported results (for brevity, available from the author upon request) suggest that accounting information and the tone of risk disclosure add value to UK firms over the period of study, as we find that increasing the proportion of upside- (downside-) risk disclosure revealed in the narrative sections of annual reports has an influential impact in raising (reducing) firm value.

4.4.3. Stock returns instead of stock prices

Prior research on value relevance (e.g., Elbakry et al., 2017; Elshandidy, 2014; Onali et al., 2017) uses two models to observe the value relevance of accounting information: the first is the price model, as introduced in our main analysis; the second is the price change/return model. In this section, we discuss our results when regressing risk information and its tone on stock returns, instead of stock prices. Both models are frequently used in examining the value relevance of accounting information (Barth et al., 2001) and both models are based on the same theoretical foundations of the residual income model. Whereas the price model is interested in what is reflected in firm value, the return model is interested in what is reflected in the change in value over a specific period.[5] Our unreported results confirm our previous conclusion on the importance of distinguishing the tone of risk disclosure in order to observe its value relevance. The results add to previous findings that give greater weight on downside than upside-risk disclosure in terms of their effect on stock returns.

5. Conclusion

This paper examines risk disclosure and its tone in UK annual reports and its impact on stock prices. Collectively, our results suggest that aggregate risk information does not add value for investors, suggesting that such information is merely routine. In contrast, the tone of risk information does seem to be important to the market, and investors value the content of the tone of the risk information (whether it reflects upside- or downside-risk disclosure). In general, our results suggest that risk-related information has valuation implications. Specifically, upside- (downside-) risk disclosure is positively (negatively) priced. We also find that the value relevance of risk information exhibits cross-sectional variations conditional on firm growth and profitability.

The extant literature on the value relevance of IFRS might be expanded in an interesting way by the incorporation of textual risk disclosure to test the extent to which the latter moderates the observed relevance of IFRS within and across countries. Further research is needed to observe the extent to which, and how, the reporting system's change (from mainly annual reports to integrated reporting and/or strategic reports) beginning in 2014 has affected the influence of risk-related disclosure on stock prices.

[5] As our paper focuses primarily on the extent to which the value relevance of risk disclosure might differ after distinguishing the tone of such disclosure (the principal aim being to look at the significance of the coefficients of these variables, rather than to compare the overall change in the value relevance of such information over time), the price model is more suitable for examining such associations (e.g., Barth et al., 2001; Onali et al., 2017).

Declaration of competing interest

None.

Appendix.

Appendix 1. Variable definitions

Variable	Definitions, measures, and sources	Scale
Variables used in the main analyses		
P_{it+1}	Average stock price over the three-month period after the annual report becomes publicly available for firm *i* at time *t*, obtained from Datastream.	%
$BVPS_{it}$	Book value per share for firm *i* at time *t*, obtained from Datastream.	%
EPS_{it}	Net income per share for firm *i* at time *t*, obtained from Datastream.	%
$AGRISKD_{it}$	Aggregate risk disclosure, measured as the proportion of all risk information disclosed in the narrative sections of the annual report. It is calculated as the number of sentences indicating risk based on our final risk word list divided by the total number of sentences coded for firm *i* at time *t*. This score is calculated based on textual analysis using QSR version 6.	%
$UPRISKD_{it}$	Upside-risk disclosure, measured as the proportion of the aggregate risk disclosure indicating favorable information about risk for firm *i* in year *t*. This score is calculated based on textual analysis using QSR version 6. Upside-risk disclosure is identified based on a specific list of words that reflect the upside risk.	%
$DNRISKD_{it}$	Downside-risk disclosure, measured as the proportion of aggregate risk disclosure indicating unfavorable information about risk for firm *i* in year *t*. This score is calculated based on textual analysis using QSR version 6. Downside-risk disclosure is identified based on a specific list of words that reflect the downside risk.	%
$NTRISKD_{it}$	Net effect of upside- and downside-risk disclosure, measured as the difference between the scores for upside- and downside-risk disclosure, as previously calculated.	%
$NURISKD_{it}$	Neutral tone, which is calculated as the difference between the score for aggregate risk disclosure and the sum of the scores for upside- and downside-risk disclosures, for firm *i* in year *t*.	%
Variables used in further analysis		
$GROWTH_{it}$	Firm growth measured by the market-to-book ratio for firm *i* in year *t*, obtained from Datastream. This ratio is used to distinguish between high-growth and low-growth firms.	1, 0
$Profitability_{it}$	Profitability measured by the return on equity for firm *i* in year *t*, obtained from Datastream. This ratio is used to distinguish between profit-making and loss-making firms.	1, 0

(*continued on next page*)

(*continued*)

Appendix 1. Variable definitions

Variable	Definitions, measures, and sources	Scale
Variables used in robustness checks		
$Tobins'Q_{it+1}$	Market-to-book ratio of total assets, calculated as total assets minus total common equity plus common shares outstanding at year-end multiplied by the share price at the release date of the current year's annual report, divided by total assets, obtained from Datastream.	%
$R_{it+1} = \frac{P_{it} - P_{it-1}}{P_{it-1}}$	where P_t is price on day *t* and P_{t-1} is price on the previous day, obtained from Datastream.	%

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