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Risk Disclosure and Company Unsystematic, Systematic, and Total Risks

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Abstract

Recently, researchers have largely studied the impact of risk communication on several factors. In this paper, we examine the association between the communication about risk through annual reports and unsystematic, systematic, and total risks. We use the content analysis method to measure risk communication and the market model to measure the three types of risk. We find that increased risk disclosure is associated with decreased unsystematic and total risks and increased systematic risk. Two complementary analyses are performed. The first of these analyses examines the impact of risk communication on company risks before, during and after the financial crisis of 2008. The second analysis distinguishes high-risk from low-risk companies. The results reveal that the impact of risk communication on company risks depends on estimated period (pre-crisis, during crisis or post-crisis). Moreover, we observe that low-risk companies reduce their risk level through more risk communication.

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1. Introduction

The global financial crisis of 2008 has highlighted the importance of communication about risk (Zhou and Wang, 2013). The lack of information was one of the most important causes of the crisis (Pol, 2012). Moreover, company risk management had a notable impact on the extent to which firms were impacted by the crisis (Brunnermeier, 2008).
Beretta and Bozzolan (2004) define risk disclosure as "the communication of information concerning firms' strategies, characteristics, operations and other external factors that have the potential to affect expected results". In addition, Linsley and Shrives (2006) suggest that a disclosure is a risk disclosure if it "informs the reader about any opportunity or prospect, or any hazard, danger, harm, threat or exposure that has already impacted the firm or may impact it in the future". Thus, On the one hand, risk communication reveals more information about risk and future uncertainty and, consequently, reduces ambiguity. On the other hand, this kind of information may increase investors' risk perceptions.

The purpose of this paper is to analyze the interplay between risk communication through annual reports and company risks (systematic, unsystematic, and total risks) during the financial crisis of 2008 and for high-risk and low-risk companies.
The impact of risk communication on company risks is an important topic in today's economies, as company risk is most important element in strategic management and a determinant factor of company's performance (Ruefli et al. 1999). Zhou and Wang (2013) note that more risk reporting leads to decreased future downside systematic risk. Campbell et al. (2014) find that firms that face a higher level of risk disclose more risk factors. Nevertheless, Linsley and Shrivesb (2006) detect no association between the number of risk disclosures and several measures of risk (gearing ratio, asset cover, book to market value of equity, and beta factor). Kravet and Muslu (2013) find that textual risk disclosures increase investors' risk perceptions. However, Kothari et al. (2009) argue that when content analysis indicates unfavorable disclosures, company risk (as measured by the cost of capital, stock return volatility, and analyst forecast dispersion) decreases significantly. In accordance with this line of research, we attempt to identify whether risk reporting may play a significant role in decreasing or increasing the level of risks.
In order to examine this association; we use three conceptions of risk (systematic, unsystematic and total risks). Because we expect that risk reporting may have different effects (depending on the type of risk), as systematic risk reflects the response of the company returns to the market movements, while unsystematic risk reflects the volatility in returns that cannot be explained by market movement. In addition, during financial crisis, the market will be affected in general, but a company's characteristics may determine the extent to which the company is impacted by the crisis. The second objective of this paper is to define whether disclosing more information about risk during the financial crisis will have different impacts on the systematic, unsystematic and total risks compared with disclosing such information before and after the crisis. Another important question concerns risky companies' behavior. We attempt to define whether risky companies' risk communication may have a different impact on the level of risk compared with low-risk companies' risk communication.
For a cross-sectional sample of sixty-four non-financial firms, the results show that more communication about risk is associated with lower unsystematic risk and higher systematic risk. Moreover, we find that risk communication during the crisis of 2008 increases unsystematic risk and total risk. Furthermore, high-risk companies' communication about risk is positively associated with total and systematic risk. By contrast, for low-risk companies, risk communication decreases the three types of risk. Thus, most investors are risk averse, and they interpret risky companies' risk communication as an additional risk, while they consider

low-risk companies' risk communication as a kind of transparency. Consequently, risky companies cannot reduce their risks by disclosing more information about risks, whereas low-risk companies have the opportunity to reduce their risk through more risk communication.

On the theoretical side, our paper contributes to three strands of literature: the literature concerning the impact of risk disclosure on systematic, unsystematic, and total risks; the literature concerning the impact of global financial crisis of 2008 on this association; and the literature concerning risk level analysis. Studies have not attempted to examine the association between risk reporting and company risks pre-crisis, post-crisis and during the crisis. Furthermore, our paper is the first (to our knowledge) to compare the impact of risk communication on company risks for high-risk and low-risk companies. Moreover, this paper makes another contribution in terms of the research design. We use the linear mixed model to mitigate the problems of cross-sectional data (heteroscedasticity and autocorrelation).

This study has a number of important implications. First, our results encourage companies to disclose more risk information through annual reports to decrease unsystematic risk and total risk. Second, our results suggest that companies should be careful in their risk communication during the crisis to avoid the negative impact of this communication. Finally, our study encourages companies to maintain an acceptable level of risk to eliminate the negative consequences of risk communication.

The structure of the paper is as follows: Section 2 outlines the background and prior studies. Section 3 presents the hypothesis development. Section 4 discusses the research design. Section 5 shows the results. Finally, section 6 presents the conclusion.

2. Background and prior studies

Previous researchers have examined the factors associated with risk communication; one of these factors is risks. Abraham and Cox (2007) examine the relationship between the quantity of narrative risk information in corporate annual reports and ownership, governance, and US listing characteristics. One of these characteristics is risks. They find a positive association between a proxy for risk and level of risk disclosure. Within a sample of 79 UK companies, Linsley and Shrivesb (2006) explore risk disclosures. The results of this study show a significant association between the number of risk disclosures and company size and the level of environmental risk. They find no association between the number of risk disclosures and five other measures of risk: gearing ratio, asset cover, book to market value of equity, and beta factor. Campbell et al. (2014) check the content of the "risk factor" section in company 10-K reports, which was created at the beginning of 2005. They note that firms that face a higher level of risk disclose more risk factors. They conclude that managers provide risk factor disclosures that meaningfully reflect the risks they face. In addition, they find that the information disclosed in the risk factor section reflects systematic risk, idiosyncratic risk, information asymmetry, and firm value. Kravet and Muslu (2013) suggest that textual risk disclosures increase investors' risk perceptions. Table 1 summarizes the studies which examine the association between risk reporting and risk level.

Table 1

Literature	Risk measures	Association between risk disclosure and firm risk
Abraham and Cox (2007)	Variance	Positive
Linsley and Shrivesb (2006)	Gearing ratio Asset cover Book to market value of equity Beta factor	No association
Campbell et al. (2014)	Standard deviation Beta	Positive
Kravet and Muslu (2013)	Standard deviation	Positive
Madrigal et al. (2015)	Beta	Positive
Zhou and Wang (2013)	Beta	No association
Kothari et al. (2009)	Cost of capital Stock return volatility Analyst forecast dispersion	Negative

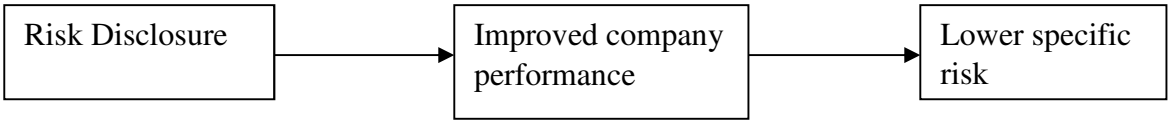
Several other studies have discussed the links between the total quantity and/or quality of disclosure in annual reports and the firm's risk level. In their Arbitrage Pricing Theory model, Handa and Linn (1993) find that a Bayesian investor attributes more systematic risk to an asset with low levels of information than to an asset with high levels of information. Kothari et al. (2009) argue that when content analysis indicates favorable disclosures, the company risk (as measured by the cost of capital, stock return volatility, and analyst forecast dispersion) declines significantly. In addition, they note that with unfavorable disclosures, risk measures increase significantly. Botosan (1997) explores the relationship between disclosure level and the cost of equity capital by regressing firm-specific estimates of cost of equity capital on market beta, firm size and disclosure level. For firms with a low analyst following, the results show that greater disclosure is associated with a lower cost of equity capital. For firms with a high analyst following, however, the author does not find any evidence of an association between the disclosure level and cost of equity capital. Jennife et al. (2008) investigate the association between voluntary disclosure, earnings quality, and cost of capital. They find that companies with good earnings quality have more expansive voluntary disclosures than companies with poor earnings quality. In addition, the results indicate that more voluntary disclosure is associated with a lower cost of capital. Lambert et al. (2007) study the impact of a firm's accounting information on its cost of capital. They show that the quality of accounting leads to a decline in the cost of capital. Sengupta (1998) indicates that firms with high disclosure quality ratings from financial analysts have a lower effective interest cost of issuing debt. Furthermore, the results show that the relative importance of disclosures is greater in situations characterized by greater market uncertainty about the company, as reflected by the variance of stock returns. Hail (2002) investigates the relationship between disclosure quality and cost of equity capital. The author finds a negative and highly significant association between the two variables.

In conclusion, previous studies have found mixed results concerning the impact of risk communication on company risks. In this paper, we address these inconsistent results. In addition, we extend our study to examine the impact of risk communication on company risks by taking into consideration the financial crisis of 2008. Moreover, we attempt to determine whether the company's level of risk plays a key role in this impact.

3. Hypothesis development

Previous literature suggests that high level of disclosure is expected to decrease the risk (Cheynel, 2013; Francis et al; 2008; Botosan and Plumlee, 2002). Whereas, risk information could increase investors' risk perceptions, resulting in an increase in company risk level. In general, we expect different impact of risk disclosure on the three types of risk used in this study.

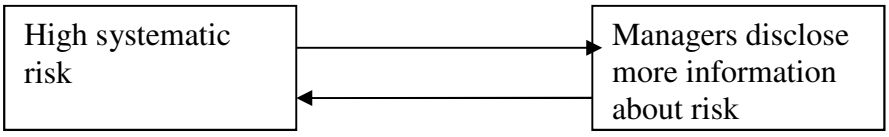
During our literature review, we noticed that researchers' interest focused on two concepts of risk, total risk and systematic risk (see table 1). Researchers have not attempted to study the impact of risk communication on unsystematic risk. This lack of attention to unsystematic risk could be because investors can eliminate unsystematic risk by holding a diversified portfolio. In general, diversification is not perfect; thus, some unsystematic risk is present in the portfolio (McClay, 1978). In the one hand, company unsystematic risk reflects the company specific risk and the variation in company performance that cannot be explained by market movement (McClay, 1978; Delgado-García et al; 2013). On the other hand, risk disclosure reflects past/future firm performance (Beretta and Bozzolan, 2004; Kravet and Muslu, 2013; and Linsley and Shrives, 2006). Hence, we expect an impact of risk disclosure on unsystematic risk. In general, previous researchers have found a positive impact of disclosure on company performance (Moumen et al; 2015; Petrova et al; 2012; Heflin et al; 2005).



Thus, we formulate accordingly our first hypothesis as follows:

H1: The communication about risk in annual reports is negatively related to company unsystematic risk.

The economic theory and the literature suggest that high levels of disclosure should reduce risks (Kothari et al; 2009; Hail, 2002; Botosan, 1997). Corporate communication about risk, however, differs from the other kinds of disclosures. Although risk information is important for investors, this kind of information may have unfavorable consequences on the company's systematic risk. Vandemaele et al. (2009) reveal that managers disclose more information about factors that drive risk when systematic risk is high.



Accordingly, we expect positive association between risk disclosure and systematic risk. Our second hypothesis is as follows:

H2: The communication about risk in annual reports is positively related to company systematic risk.

The third hypothesis is concerned with examining the association between risk disclosure and company total risk. We could assume that companies that disclose more risk information through annual reports could help investors to understand better company risk position and company risk could then decrease. Therefore, increased risk disclosure could have negative impact on company total risk. Moreover, total risk is mostly caused by unsystematic risk

(Goyal and Santa-Clara, 2003). Thus, we expect that more communication about risk will reduce the total risk.

H3: The communication about risk in annual reports is negatively related to company total risk.

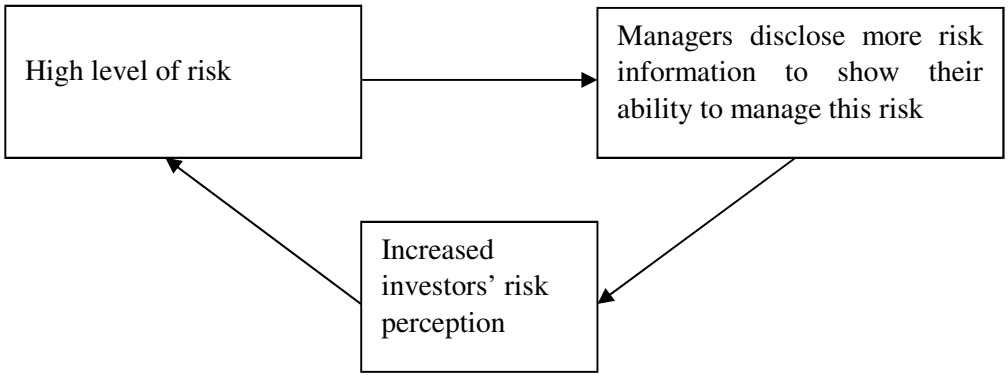
Oxford English Dictionary defines crisis term as "time of intense difficulty or danger". Thus, financial crisis imposes extensive instability and uncertainty on companies. In general, companies with a high quality of reporting during the crisis suffer fewer negative impacts (Lin et al; 2015). However, we cannot completely eliminate the negative impact of the crisis. Consequently, we propose the following hypotheses:

H4: The communication about risk increases the unsystematic risk during the financial crisis.

H5: The communication about risk increases the systematic risk during the financial crisis.

H6: The communication about risk increases the total risk during the financial crisis.

Our next hypothesis is related to the company level of risk. We could suggest that risky companies could disclose more risk information to explain their risk and how they manage this risk. Moreover, because investors are risk averse, they could interpret this risk information as additional risk which is reflected in increased risk. By contrast, investor could interpret risk information disclosed by low-risk companies as more disclosure, perhaps because they are confident in company risk management abilities.



Previous literature has found a positive association between company's' level of risks and risk disclosure (Abraham and Cox, 2007; Campbell et al; 2014). In addition, studies have noted that this risk information is reflected in systematic risk, idiosyncratic risk, information asymmetry, and company value (Campbell et al; 2014). Therefore, we formulate the following hypotheses:

H7: The communication about risk increases the unsystematic, systematic and total risks for high-risk firms.

H8: The communication about risk decreases unsystematic, systematic and total risks for low-risk firms.

4. Research Design

4.1. Sample and Data

The sample used in this study is taken from the SBF 120 index for the period from 2006 to 2011. We consider all non-financial companies for which we had obtained annual reports from their website or via an e-mail. The data are organized in a panel of 64 firms over six years; thus, the final sample consists of 384 annual reports. Data on other variables used in this study are taken from DataStream.

4.2. Dependent variables (systematic, unsystematic, and total risks)

We follow the methods of Delgado-García et al. (2011) to calculate systematic, unsystematic and total risk variables. Delgado-García et al. (2011) estimate beta using the market model

(Sharpe, 1964), which assumes a linear relationship between actual returns of stock i in period t and actual returns of market m in period t in the form:

$$\boldsymbol{R_i = \alpha_i + \beta_i R_m + \varepsilon_i} \quad \textbf{(1)}$$

Where R_i is the return on the firm i for period *t*; R_m is the return on the market portfolio.
The regression of equation (1) provides an estimate of beta (systematic risk) for firm i.
From the market model, Delgado-García et al. (2011) also calculate unsystematic risk and total risk. Total risk, i.e; the variance in returns for each firm, is calculated as follows:

$$\boldsymbol{\sigma^2(R_i) = \beta_i^2 \sigma_m^2 + \sigma_i^2} \quad \textbf{(2)}$$

Where $\sigma^2(R_i)$ is a measure of total risk for firm i, and σ_i^2 is the standard deviation of the error term (the unsystematic risk for firm i over the estimation period). We use daily stock price data to calculate the three risk variables.

4.3. Independent Variable

We use content analysis to measure the risk communication variable. We consider the 3503 risk words used in Zreik and Louhichi (2014)'s paper. Our method involves counting the frequency of these risk words in the 384 annual reports.

4.4. Control variables

To examine the association between risk disclosure and systematic, unsystematic and total risks, we control for several determinants of risk in the model. Over the years, numerous studies have investigated the determinants of company risk (systematic, unsystematic, and total risks). Li-Tzang and SooCheong (2008) reveal a significant positive association between leverage and unsystematic risk. Moreover, they find that profitability and size are negatively related to unsystematic risk. Several studies have indicated that liquidity, profitability, activity ratios, and asset turnover are important determinants of systematic risk (Ang et al; 1985; Loo and Ramasamy, 1989; Kim et al; 2002; and Gu and Kim, 2002). Moreover, previous literature has found a significant association between total risk and firm size, dividends, leverage, market power and industry concentration (Ang et al; 1985; Sullivan, 1978; Moyer and Chatfield, 1983).
Thus, we control for the following variables in our model: **Company size,** as measured by market capitalization; **Leverage ratio,** as measured by debt to equity ratio; **Operating efficiency,** as measured by asset turnover ratio (total sales / total assets); and **Liquidity,** as measured by bid-ask spread.

4.5. The Empirical Model

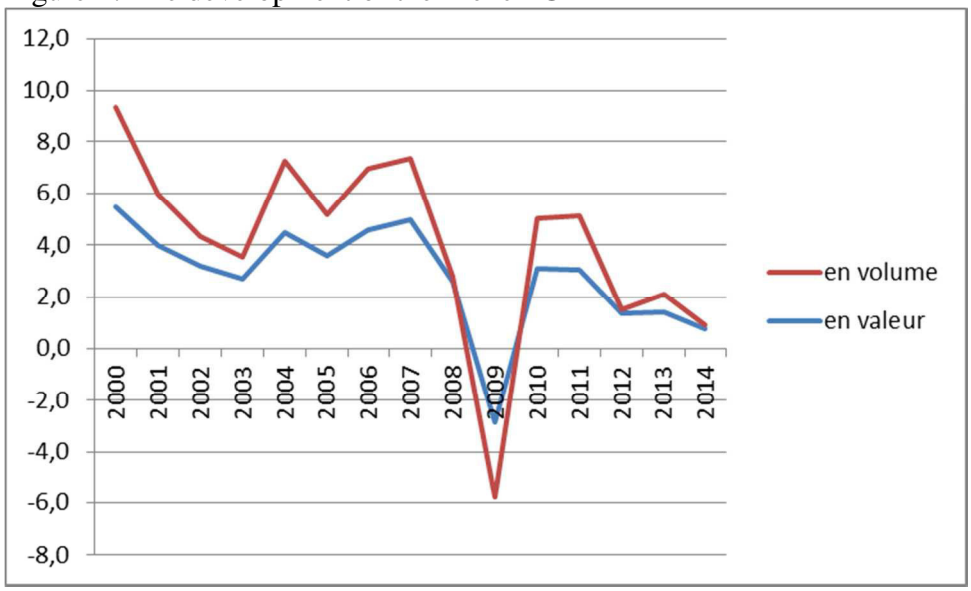
To evaluate the association between the communication about risk and company risks, we employ three regression models:

$$Risk_{it} = \beta + \beta 1 RiskReport_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$$

Where $Risk_{it}$ is unsystematic risk variable σ_i^2, systematic risk variable beta, and total risk variable $\sigma^2(R_i)$,$RiskRepot_{it}$ is the communication about risk; $Size_{it}$ indicates company size, as measured by market capitalization; $Leverage_{it}$ indicates the leverage ratio, as measured by debt to equity ratio; $OpEff_{it}$ is the operating efficiency variable, as measured by asset turnover ratio (total sales / total assets); finally, BAS_{it} is liquidity, as measured by bid-ask spread.

To compare the impact of the communication about risk on company risks before, during and after the crisis of 2008, we split our sample period (2006-2011) into pre-, during and post-crisis periods. The financial crisis began in August 2007 in the United States. In 2008, the crisis started to impact the global economy. France was no exception. To determine the pre-during and post-crisis periods, and because we study the French market, we spilt the sample according to the development of the French GDP, which is an important economic indicator. When a crisis hits an economy, everything collapses and the growth of GDP decreases.

Figure 1: The development of the French GDP



Source: INSEE national accounts-base 2010 (red line in volume, blue line in value)

Figure 1 shows that the French GDP growth started to decrease in 2008 and continued to decrease until 2009. After 2009, the French economy started to recover.

Accordingly, we spilt the sample into the pre-crisis period (from 2006 to 2007), during crisis period (from 2008 to 2009), and post-crisis period (from 2010 to 2011). We run several models:

$$Risk_{it} = \beta + \beta 1 Pre - crisis_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$$

$$Risk_{it} = \beta + \beta 1 During - crisis_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$$

$$Risk_{it} = \beta + \beta 1 Post - crisis_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$$

Where $Risk_{it}$ is unsystematic risk variable σ_i^2, systematic risk variable beta, and total risk variable $\sigma^2(R_i)$, $Pre - crisis_{it}$ is the communication about risk before the financial crisis (2006-2007), $During - crisis_{it}$ is the communication about risk during the crisis (2008-2009), and $Post - crisis_{it}$ is the communication about risk after the financial crisis (2010-2011). Furthermore, $Size_{it}$ indicates company size, as measured by market capitalization; $Leverage_{it}$ indicates the leverage ratio, as measured by debt to equity ratio; $OpEff_{it}$ is the operating efficiency variable, as measured by asset turnover ratio (total sales / total assets); finally, BAS_{it} is liquidity, as measured by bid-ask spread.

To test whether the communication about risk has the same impact on high-risk and low-risk firms' risks, we run the following models:

$$Risk_{it} = \beta + \beta 1 High - risk_{it} + \beta 2 Size_{it} + \beta 4 leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$$

$$Risk_{it} = \beta + \beta 1 Low - risk_{it} + \beta 2 Size_{it} + \beta 4 leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$$

Where $Risk_{it}$ is unsystematic risk variable σ_i^2, systematic risk variable beta, and total risk variable $\sigma^2(R_i)$, $High - risk$ is high-risk firms' communication about risk, and $Low - risk$ is low-risk firms' communication about risk. Furthermore, $Size_{it}$ indicates company size, as measured by market capitalization; $Leverage_{it}$ indicates the leverage ratio, as measured by debt to equity ratio; $OpEff_{it}$ is the operating efficiency variable, as measured by asset turnover ratio (total sales / total assets); finally, BAS_{it} is liquidity, as measured by bid-ask spread.

We use a linear mixed model (LMM) to analyze our panel data. The LMM is a statistical model containing both fixed and random effects in which the residuals are normally distributed but may not be independent or have constant variance (West et al., 2014). One of the most important advantages of the LMM is that it can eliminate the complexity of the typical panel data set (Tiwari and Shukla, 2011). It can be used to describe nonlinear relationships across time in a panel dataset with multiple missing data points (Edwards, 2000). In addition, it is able to treat time as a continuous variable, a categorical variable or both (Krueger, 2004). Moreover, the LMM reduces the problems of cross-sectional data (heteroscedasticity and autocorrelation) (Elshandidy et al., 2013).

5. Analysis and Results

5.1. Descriptive Statistics and Correlation Matrix

Table 2 displays the descriptive statistics for the variables used in the analysis. The sample contains 64 firms (id) over six years (t) (2006-2011). The mean of the communication about risk variable is approximately 2717. This signifies that the average number of risk words published in annual reports is approximately 2700 words. Concerning the three risk variables, we note that the total risk ranges from 0.0001 to 0.002, systematic risk is ranked between 0.3 and 2, and unsystematic risk ranges from 0.007 to 0.031. The systematic risk has the highest standard deviation (0.31) among our three variables of risk. The mean risk communication during the financial crisis is lower than the means before and after the crisis. In addition, the mean risk communication of high-risk firms is lower than that of low-risk firms. Low-risk companies communicate more risk information than high-risk companies.

Table 2: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
RiskReport	2717.222	2391.183	0	12392
TotalRisk	.0005082	.0003393	.0001184	.0017324
SystematicRisk	.8640195	.3087132	.2495499	1.773742
UnsystematicRisk	.0162595	.0051961	.0075838	.0307076
Size	12424.14	20918.78	137.23	148470.4
Leverage	80.43489	157.9762	-2129.63	878.15
OpEff	8.150795	22.64169	-287.5	62.64
BAS	.0016929	.0047104	-.0304215	.0236009
Pre-crisis	824.6872	1660.479	0	12392
During-crisis	841.9412	1745.508	0	11504
Post-crisis	1050.594	2194.869	0	12328
High-risk	929.5588	1827.818	0	11405
Low-risk	1787.663	2389.398	0	12392

Where $RiskRepot_{it}$ is the communication about risk, $TotalRisk_{it}$ is total risk variable $\sigma^2(R_i)$, $SystematicRisk_{it}$ is systematic risk variable beta, $UnSystematicRisk_{it}$ is unsystematic risk variable σ_i^2, $Size_{it}$ indicates company size measured by market capitalization, $Leverage_{it}$ indicates the leverage ratio measured by debt to equity ratio, $OpEff_{it}$ is the operating efficiency variable measured by asset turnover ratio (total sales / total assets), BAS_{it} is the liquidity measured by bid-ask spread, $Pre-crisis_{it}$ is the communication about risk before the financial crisis during 2006-2007, $During-crisis_{it}$ is the communication about risk during 2008-2009, $Post-crisis_{it}$ is the communication about risk after the financial crisis during 2010-2011, $High-risk$ is the communication about potential risk for high-risk firms, $Low-risk$ is the communication about risk for low-risk firms.

Table 3 presents the correlation matrix. We observe that systematic risk correlates positively with risk reporting (the communication about risk) because unsystematic risk correlates negatively with risk reporting. Total risk does not have a significant correlation with risk

reporting. In addition, there is a high correlation between total risk and unsystematic risk (approximately 80%), while the correlation between systematic risk and total risk is approximately 47%.

Table 3 : Correlation Matrex

	RiskReport	TotalRisk	SystematicRisk	UnsystematicRisk	Size	Leverage	OpEff	BAS
RiskReport	1.0000							
TotalRisk	-0.0239 (0.6498)	1.0000						
SystematicRisk	0.1513*** (0.0038)	0.4748*** (0.0000)	1.0000					
UnsystematicRisk	-0.1081** (0.0393)	0.8036*** (0.0000)	0.1882*** (0.0003)	1.0000				
Size	0.3085*** (0.0000)	-0.0683 (0.1873)	0.1204** (0.0199)	0.2116*** (0.0000)	1.0000			
Leverage	-0.0427 (0.4262)	0.1280** (0.0166)	0.0066 (0.9027	0.1341** (0.0120)	0.0257 (0.6267)	1.0000		
OpEff	-0.1139* (0.0337)	-0.1705*** (0.0014)	-0.1306** (0.0148)	-0.2094*** (0.0001)	0.0636 (0.2303)	0.2513*** (0.0000)	1.0000	
BAS	-0.0192 (0.7130	-0.0277 (0.5961)	-0.1834*** (0.0004)	0.0813 (0.1194)	-0.0305 (0.5541)	-0.0397 (0.4560)	-0.0165 (0.7581)	1.0000

Where $RiskRepot_{it}$ is the communication about potential risk, $TotalRisk_{it}$ is total risk variable $\sigma^2(R_i)$, $SystematicRisk_{it}$ is systematic risk variable beta, $UnSystematicRisk_{it}$ is unsystematic risk variable σ_i^2, $Size_{it}$ indicates company size measured by market capitalization, $Leverage_{it}$ indicates the leverage ratio measured by debt to equity ratio, $OpEff_{it}$ is the operating efficiency variable measured by asset turnover ratio (total sales / total assets), BAS_{it} is the liquidity measured by bid-ask spread.

* Significant at the 10 % level

** Significant at 5% level.

*** Significant at 1% level.

5.2. The Association Between Risk Reporting and Company Risks

In this section, we analyze the impact of risk reporting on three variables of risk, unsystematic, systematic, and total risks. The results in table 4 reveal that risk reporting

reduces unsystematic risk, while it increases systematic risk. We do not detect any significant impact of risk reporting on total risk despite the negative sign of the estimated coefficient.

Table 4: Risk Reporting and Company Risks

Table 3 presents the results of linear mixed model (LMM) of the following models:

$$UnSystematicRisk_{it} = \beta + \beta 1 RiskReport_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$$
$$SystematicRisk_{it} = \beta + \beta 1 RiskReport_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$$
$$TotalRisk_{it} = \beta + \beta 1 RiskReport_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$$

Where $UnSystematicRisk_{it}$ is unsystematic risk variable σ_i^2, $SystematicRisk_{it}$ is systematic risk variable beta, $TotalRisk_{it}$ is total risk variable $\sigma^2(R_i)$, $RiskRepot_{it}$ is the communication about risk, $Size_{it}$ indicates company size measured by market capitalization, $Leverage_{it}$ indicates the leverage ratio measured by debt to equity ratio, $OpEff_{it}$ is the operating efficiency variable measured by asset turnover ratio (total sales / total assets), BAS_{it} is the liquidity measured by bid-ask spread.

* Significant at the 10 % level
** Significant at 5% level.
*** Significant at 1% level.

	UnsystematicRisk	**SystematicRisk**	**TotalRisk**
RiskReport	-.0000025** (0.046)	.0000142* (0.057)	-.0000000051 (0.542)
Size	-.000000045*** (0.030)	0.0000015* (0.063)	-.00000000066 (0.482)
Leverage	.0000048* (0.082)	.0001819 (0.116)	.00000027 (0.149)
OpEff	-.0000878*** (0.000)	-.0039851*** (0.000)	-.0000056*** (0.000)
BAS	.073462 (0.202)	-10.78492*** (0.002)	-.0013353 (0.722)
_cons	.0178011*** (0.000)	.8456206*** (0.000)	.0005678*** (0.000)

Table 3 tests the following hypotheses:
H1: The communication about risk in annual reports is negatively related to company unsystematic risk.
H2: The communication about risk in annual reports is positively related to company systematic risk.
H3: The communication about risk in annual reports is negatively related to company total risk.

According to our results, we accept the first and second hypotheses. In regards to control variables, size has a negative impact on unsystematic risk and total risk and a positive impact on systematic risk. Furthermore, we find that leverage has a positive effect on the three types of risk. We notice that operating efficiency reduces the risks. Finally, we observe that liquidity negatively impacts systematic risk.

Our results suggest that managers are able to reduce company unsystematic risk by disclosing more information about risk. Moreover, our results reveal that, on the one hand, investors attribute more systematic risk to a company that provides more risk information in its annual reports than to a company that provides less risk information. On the other hand, investors attribute less unsystematic risk to a company that provides more risk information than to a company that provides less risk information.

Both effects of risk disclosure are based on two dimensions: First, more risk disclosure means that the company is transparent, which will attract stakeholders. Transparency also ensures stakeholder stability over time, which will improve firms' performance and lower their unsystematic risk. Second, more risk information disclosure means that the company faces a higher level of risk. This implies a greater sensibility to downturns in the market and, consequently, a higher systematic risk. In addition, our results suggest that risk disclosure does not impact a company's total risk; that is, the impact of risk disclosure on reducing unsystematic risk compensates for its impact on increasing systematic risk. The information about risk in annual reports is consequently reflected in company systematic risk. The findings are consistent with (Campbell et al; 2014; Handa and Linn, 1993 and Vandemaele et al; 2009), who observe that managers disclose more risk information when company systematic risk is high.

Concerning the control variables, the results are consistent with the findings of of previous studies (Iqbal and Shah, 2012; Hong and Sarkar, 2007; Li-Tzang and SooCheong, 2008; Ang et al; 1985; and Sullivan, 1978). The negative impact of risk communication on unsystematic risk is rather important for several reasons. First, it is possible to eliminate unsystematic risk through diversification; however, as previously stated, diversification is not perfect. It is important to find an additional way to reduce unsystematic risk. Second, in table 2, we observe that the correlation between total risk and systematic risk is approximately 47 %, whereas the correlation between unsystematic risk and total risk is approximately 80%. Thus, by reducing unsystematic risk, we reduce an important part of company total risk.

5.3. The Impact of the Financial Crisis

The purpose of this section is to determine whether the impact of risk reporting on company risks differ before, during and after the financial crisis of 2008. We split up the sample into three groups. The first group contains the data before the financial crisis of 2008, i.e. from 2006 to 2007. The second group includes the data during the financial crisis, i.e. 2008-2009. The final group contains the data after the crisis, i.e. from 2010 to 2011. The results are presented in tables 5, 6 and 7.

Table 5 shows that the communication of risk information during the financial crisis increases company unsystematic risk, while the communication of risk information before and after the crisis decreases unsystematic risk. Thus, we accept H4. The results prove that the generous disclosure of risk information during the crisis increases company unsystematic risk. Concerning the control variables, the impact of these variables on unsystematic risk does not change. We identify a negative impact of size, positive impact of leverage, and negative impact of operating efficiency on unsystematic risk. By contrast, bid-ask spread does not impact company unsystematic risk.

Table 5: Risk Reporting and Unsystematic Risk pre, during and post the crisis

Table 4 presents the results of linear mixed model (LMM) of the following models:

$$UnSystematicRisk_{it} = \beta + \beta 1 Pre - crisis_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$$

$$UnSystematicRisk_{it} = \beta + \beta 1 During - crisis_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$$

$$UnSystematicRisk_{it} = \beta + \beta 1 Post - crisis_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$$

Where $\boldsymbol{UnSystematicRisk_{it}}$ is unsystematic risk variable $\boldsymbol{\sigma_i^2}$, $\boldsymbol{Pre - crisis_{it}}$ is the communication about risk before the financial crisis during 2006-2007, $\boldsymbol{During - crisis_{it}}$ is the communication about risk during 2008-2009, $\boldsymbol{Post - crisis_{it}}$ is the communication about risk after the financial crisis during 2010-2011, $\boldsymbol{Size_{it}}$ indicates company size measured by market capitalization, $\boldsymbol{Leverage_{it}}$ indicates the leverage ratio measured by debt to equity ratio, $\boldsymbol{OpEff_{it}}$ is the operating efficiency variable measured by asset turnover ratio (total sales / total assets), finally, $\boldsymbol{BAS_{it}}$ is the liquidity measured by bid-ask spread bid-ask spread.

* Significant at the 10 % level
** Significant at 5% level.
*** Significant at 1% level.

UnsystematicRisk	Pre-crisis	During-crisis	Post-crisis
RiskReport	-.0000006*** (0.000)	.0000011*** (0.000)	-.00000033*** (0.000)
Size	-.000000046*** (0.001)	-.000000068*** (0.000)	-.000000046*** (0.001)
Leverage	.000005* (0.066)	.000004 (0.126)	.0000041 (0.120)
OpEff	-.000078*** (0.001)	-.000086*** (0.000)	-.0000927*** (0.001)
BAS	.0806837 (0.155)	.0605127 (0.285)	.0556183 (0.314)
_cons	.017549*** (0.000)	.0164447*** (0.000)	.0179565*** (0.000)

Table 4 tests the following hypothesis:
H4: The communication about risk increases the unsystematic risk during the financial crisis.

Table 6: Risk Reporting and Systematic Risk pre, during and post the crisis

Table 5 presents the results of linear mixed model (LMM) of the following models:
$SystematicRisk_{it} = \beta + \beta 1 Pre - crisis_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$
$SystematicRisk_{it} = \beta + \beta 1 During - crisis_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$
$SystematicRisk_{it} = \beta + \beta 1 Post - crisis_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$
Where $\boldsymbol{SystematicRisk_{it}}$ is systematic risk variable beta, , $\boldsymbol{Pre - crisis_{it}}$ is the communication about risk before the financial crisis during 2006-2007, $\boldsymbol{During - crisis_{it}}$ is the communication about risk during 2008-2009, $\boldsymbol{Post - crisis_{it}}$ is the communication about risk after the financial crisis during 2010-2011, $\boldsymbol{Size_{it}}$ indicates company size measured by market capitalization, $\boldsymbol{Leverage_{it}}$ indicates the leverage ratio measured by debt to equity ratio, $\boldsymbol{OpEff_{it}}$ is the operating efficiency variable measured by asset turnover ratio (total sales / total assets), finally, $\boldsymbol{BAS_{it}}$ is the liquidity measured by bid-ask spread bid-ask spread.
* Significant at the 10 % level
** Significant at 5% level.
*** Significant at 1% level.

SystematicRisk	**Pre-crisis**	**During-crisis**	**Post-crisis**
RiskReport	.000004 (0.684)	.000004 (0.707)	.000011 (0.175)
Size	.000002*** (0.010)	.000002*** (0.009)	.000002** (0.016)
Leverage	.00018 (0.121)	.0001801 (0.121)	.0001788 (0.123)
OpEff	-.0041973*** (0.000)	-.0041016*** (0.000)	-.0041455*** (0.000)
BAS	-10.74906*** (0.002)	-10.77521*** (0.002)	-10.659303*** (0.002)
_cons	.8773519*** (0.000)	.8766107*** (0.000)	.8706782*** (0.000)

Table 5 tests the following hypothesis:
H5: The communication about risk increases the systematic risk during the financial crisis.

Table 6 shows that there is a positive impact of risk communication on systematic risk pre-, during, and post-crisis. Although the estimated coefficient has a positive sign, it is not statistically significant. We thus reject H5. In regards to the control variables, we find a positive impact of size, negative impact of operating efficiency, and negative impact of bid-ask spread on systematic risk, while leverage does not impact company systematic risk. Table 7 shows that the communication of information about risk during the financial crisis leads to increased company total risk.

Table 7: Risk Reporting and Total Risk pre, during and post the crisis

Table 6 presents the results of linear mixed model (LMM) of the following models:
$TotalRisk_{it} = \beta + \beta 1 Pre - crisis_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$
$TotalRisk_{it\ it} = \beta + \beta 1 During - crisis_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$
$TotalRisk_{it\ it} = \beta + \beta 1 Post - crisis_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$
Where $\boldsymbol{TotalRisk_{it}}$ is total risk variable $\boldsymbol{\sigma^2(R_i)}$, $\boldsymbol{Pre - crisis_{it}}$ is the communication about risk before the financial crisis during 2006-2007, $\boldsymbol{During - crisis_{it}}$ is the communication about risk during 2008-2009, $\boldsymbol{Post - crisis_{it}}$ is the communication about risk after the financial crisis during 2010-2011, $\boldsymbol{Size_{it}}$ indicates company size measured by market capitalization, $\boldsymbol{Leverage_{it}}$ indicates the leverage ratio measured by debt to equity ratio, $\boldsymbol{OpEff_{it}}$ is the operating efficiency variable measured by asset turnover ratio (total sales / total assets), finally, $\boldsymbol{BAS_{it}}$ is the liquidity measured by bid-ask spread bid-ask spread.
* Significant at the 10 % level
** Significant at 5% level.
*** Significant at 1% level.

Total risk	**Pre-crisis**	**During-crisis**	**Post-crisis**
RiskReport	-.000000061*** (0.000)	.00000008*** (0.000)	-.00000003** (0.018)
Size	-.00000000003 (0.976)	-.000000001* (0.074)	-.0000000005 (0.584)
Leverage	.00000029* (0.100)	.00000021 (0.216)	.00000025 (0.177)
OpEff	-.0000048*** (0.002)	-.000005*** (0.001)	-.0000057*** (0.000)
BAS	-.0011107 (0.755)	-.0021273 (0.534)	-.0016373 (0.660)
_cons	.0005889*** (0.000)	.0004944*** (0.000)	.0005766*** (0.000)

Table 6 tests the following hypothesis:
H6: The communication about risk increases the total risk during the financial crisis.

Thus, we accept H6. The results show a significant negative impact of risk reporting on total risk before and after the crisis. Company size does not impact total risk before or after the crisis, while there is a negative association between size and company total risk during the crisis. Leverage augments total risk in general, but we do not obtain significant results except before the crisis. Operating efficiency reduces a firm's total risk. Bid-ask spread does not impact company total risk.

In conclusion, the effects of risk disclosure differ according to the crisis period. Our results suggest that investors' risk sensitivity is higher during a crisis, which is reflected in increased unsystematic and total risk. In addition, our findings indicate that risk disclosure has no significant impact on systematic risk. This result could be interpreted as meaning that risk disclosure is reflected in unsystematic risk, and thus its impact on unsystematic risk during a crisis is clearer than its impact on systematic risk. Furthermore, more risk information during the crisis will not impact the level of systematic risk. Thus, the intensive risk language in annual reports increases company unsystematic and total risks during the crisis. Whereas this intensive risk language decreases unsystematic and total risks in a normal economy. Our results are consistent with the fact that during the crisis, investors treat risk information as risk

rather than as transparency. In addition, our results are consistent with Zhou and Wang (2013), Pol (2012) and Brunnermeier (2008), who find that the communication about risk before the crisis had a notable impact on the extent to which firms were impacted by the crisis. Moreover, we detect some other factors that can mitigate the negative impact of the crisis. These factors differ according to the kind of risk. We note that company size and operating efficiency play an active role in reducing unsystematic and total risks. Furthermore, operating efficiency is a factor that reduces systematic risk.

5.4. Additional Analyses

It is important to test whether the impact of risk communication on company risks differs according to a company's level of risk. We distinguish between high-risk and low-risk companies by using beta. If beta is more than one, the company is considered a high-risk company (Elshandidy et al; 2013).

Table 8: Risk Reporting and Unsystematic Risk for high-low-risk companies

Table 7 presents the results of linear mixed model (LMM) of the following models:
$UnSystematicRisk_{it} = \beta + \beta 1High - risk_{it} + \beta 2Size_{it} + \beta 4Leverage_{it} + \beta 5OpEff_{it} + \beta 6BAS_{it} + \varepsilon_{it}$
$UnSystematicRisk_{it} = \beta + \beta 1Low - risk_{it} + \beta 2Size_{it} + \beta 4Leverage_{it} + \beta 5OpEff_{it} + \beta 6BAS_{it} + \varepsilon_{it}$
Where $UnSystematicRisk_{it}$ is unsystematic risk variable σ_i^2, $High - risk$ is the communication about risk for high-risk firms, $Low - risk$ is the communication about risk for low-risk firms, $Size_{it}$ indicates company size measured by market capitalization, $Leverage_{it}$ indicates the leverage ratio measured by debt to equity ratio, $OpEff_{it}$ is the operating efficiency variable measured by asset turnover ratio (total sales / total assets), finally, BAS_{it} is the liquidity measured by bid-ask spread.
* Significant at the 10 % level
** Significant at 5% level.
*** Significant at 1% level.

UnsystematicRisk	**High-risk**	**Low-risk**
RiskReport	.00000016 (0.278)	-.00000034*** (0.005)
Size	-.00000006*** (0.000)	- .000000047*** (0.001)
Leverage	.0000047* (0.088)	.0000049* (0.075)
OpEff	-.000085*** (0.000)	-.0000863*** (0.000)
BAS	.0793984 (0.171)	.0843387 (0.141)
_cons	.0170944*** (0.000)	.0177126*** (0.000)

Table 8 presents the impact of risk communication on unsystematic risk for low- and high-risk companies. The results show a negative impact of risk reporting on unsystematic risk for low-risk companies. We find no significant association between risk reporting and unsystematic risk for high-risk companies; however, the sign of the estimated coefficient is positive. Table 9 summarizes the results regarding the impact of risk reporting on the systematic risk of high-risk and low-risk companies. We find that risk reporting reduces low-risk firms' systematic risk but increases high-risk firms' systematic risk.

For high-risk firms, company size does not have a significant association with systematic risk. However, bigger firms in the low-risk group face greater systematic risk.

Table 9: Risk Reporting and Systematic Risk for high-low-risk companies

Table 8 presents the results of linear mixed model (LMM) of the following models:
$SystematicRisk_{it} = \beta + \beta 1High - risk_{it} + \beta 2Size_{it} + \beta 4Leverage_{it} + \beta 5OpEff_{it} + \beta 6BAS_{it} + \varepsilon_{it}$
$SystematicRisk_{it} = \beta + \beta 1Low - risk_{it} + \beta 2Size_{it} + \beta 4Leverage_{it} + \beta 5OpEff_{it} + \beta 6BAS_{it} + \varepsilon_{it}$
Where $SystematicRisk_{it}$ is systematic risk variable beta, $High - risk$ is the communication about risk for high-risk firms, $Low - risk$ is the communication about risk for low-risk firms, $Size_{it}$ indicates company size measured by market capitalization, $Leverage_{it}$ indicates the leverage ratio measured by debt to equity ratio, $OpEff_{it}$ is the operating efficiency variable measured by asset turnover ratio (total sales / total assets), finally, BAS_{it} is the liquidity measured by bid-ask spread.
* Significant at the 10 % level
** Significant at 5% level.
*** Significant at 1% level.

SystematicRisk	High-risk	Low-risk
RiskReport	.0001014*** (0.000)	-.0000515*** (0.000)
Size	.00000074 (0.323)	.0000034*** (0.000)
Leverage	.0002479*** (0.007)	.0002058* (0.055)
OpEff	-.0026933*** (0.002)	-.0040771*** (0.000)
BAS	-6.13052** (0.024)	-8.203647*** (0.010)
_cons	.7739401*** (0.000)	.9500416*** (0.000)

Table 8 tests the following hypotheses:
H7: The communication about risk increases the unsystematic, systematic and total risk for high-risk firms.
H8: The communication about risk decreases unsystematic, systematic and total risk for low-risk firms.

Table 10 shows the negative impact of the communication of risk on total risk for the low-risk group and the positive impact for the high-risk group. In conclusion, we accept H7 and H8, Because most investors are risk averse, they interpret risky companies' risk communication as an additional risk, while they consider low-risk companies' risk communication as a kind of transparency. Prior risk report studies have not tested this association. Instead, they have tested the relationship between risk level and risk disclosure without discriminating between high- and low-risk companies (Abraham and Cox, 2007; Campbell et al; 2014; Linsley and Shrivesb, 2006).

In conclusion, our results show that more risk disclosure decreases firms' three types of risk; however, this information increases firms' systematic and total risk because investors are more sensitive to risk information when firms are high risk. Thus, risky companies cannot reduce their risks by disclosing more information about risks, whereas low-risk companies have the opportunity to reduce their risks through more risk communication. This result encourages companies to maintain an acceptable level of risk to eliminate the possible negative effects of risk communication.

Table 10: Risk Reporting and Total Risk for high-low-risk firms

Table 9 presents the results of linear mixed model (LMM) of the following models:

$TotalRisk_{it} = \beta + \beta 1 High - risk_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$
$TotalRisk_{it} = \beta + \beta 1 Low - risk_{it} + \beta 2 Size_{it} + \beta 4 Leverage_{it} + \beta 5 OpEff_{it} + \beta 6 BAS_{it} + \varepsilon_{it}$

Where $TotalRisk_{it}$ is total risk variable $\sigma^2(R_i)$, $High - risk$ is the communication about risk for high-risk firms, $Low - risk$ is the communication about risk for low-risk firms, $Size_{it}$ indicates company size measured by market capitalization, $Leverage_{it}$ indicates the leverage ratio measured by debt to equity ratio, $OpEff_{it}$ is the operating efficiency variable measured by asset turnover ratio (total sales / total assets), finally, BAS_{it} is the liquidity measured by bid-ask spread.

* Significant at the 10 % level
** Significant at 5% level.
*** Significant at 1% level.

Total Risk	High-risk	Low-risk
RiskReport	.000000056*** (0.000)	-.00000004*** (0.000)
Size	-.000000002* (0.072)	.0000000003 (0.772)
Leverage	.00000027 (0.132)	.00000028 (0.120)
OpEff	-.0000052*** (0.001)	-.0000056*** (0.000)
BAS	.0011539 (0.748)	.0004677 (0.897)
_cons	.0005034*** (0.000)	.0006126*** (0.000)

Table 9 tests the following hypotheses:
H7: The communication about risk increases the unsystematic, systematic and total risk for high-risk firms.
H8: The communication about risk decreases unsystematic, systematic and total risk for low-risk firms.

6. Conclusion

In this paper, we attempted to determine whether the financial crisis of 2008 impacts this association between risk reporting and company risks. We found that during the financial crisis, the communication about risk increases company unsystematic and total risks. Furthermore, we tested the role of a company's risk level in determining the impact of risk reporting on the company's risks. We detected that communication about risk information increases high-risk companies' total and systematic risks and decreases low-risk companies' risk. Our paper opens the door for future researchers. Future studies, for example, could attempt to define the other factors that can impact company risks during the crisis. In addition, this study has several implications. First, our results encourage companies to disclose more information about risks to reduce unsystematic and total risks. Second, we conclude that greater disclosure of risk information during a crisis will have a negative impact on a company's risk level. Finally, our results encourage companies to maintain an acceptable level of risk.

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