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The Effect of the 2007/2008 Financial Crisis on Enterprise Risk Management Disclosure of Top US Banks

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We document the effect of the 2007/2008 financial crisis on the volume and the quality of enterprise risk management (ERM) disclosure in the annual reports of the largest US banks, and analyze its determinants. Using a content analysis approach of the annual reports form 10-K for the years 2006, 2007, 2008, and 2009, we find that the ERM disclosure is significantly and positively associated with the crisis, bank size, board independence, duality and significantly and negatively associated with profitability, leverage, and board size. This paper seeks to fill a gap in the literature by investigating the effect of the crisis on ERM disclosure in the US banking sector context, and gives an insight into the factors affecting risk disclosure practices during the financial crisis.

Keywords: enterprise risk management (ERM), financial crisis, risk disclosure, content analysis, US banks

Introduction

Due to technological development, the increasing pace of international business and the rapid development of sophisticated financial instruments which allow the interconnections of international relations to expand and to become more complex, the late 20th century and the early 21st century witnessed the rise of a new spectrum of risks surpassing the traditional ones.

At a time when the volatility and uncertainty of the economic and business environment continue to increase, understanding the risks and their evolution becomes a crucial issue. This leads to a much greater awareness of the importance of implementing a risk management framework capable of dealing permanently with emerging risks (using an integrated risk management process) rather than treating each new risk separately (using the old silo form for the risk management process).

Thus, the enterprise risk management (ERM) process takes an important place in both financial and non-financial companies and especially in the banking industry considered to be the most heavily regulated industry in the world since banks play a crucial role in the process of money creation. It is also the most fragile and vulnerable to contagion because of the interconnection between the banking sector and other sectors of the economy which causes the financial crisis to spread.

This was recently demonstrated through the subprime crisis of 2007-2008 that has been considered the worst since the great depression of 1929. The securitization of non-performing loans mainly related to mortgages and the collapse of the US subprime mortgage market were the primary causes of the subprime

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crisis. The loss of confidence was the major consequence linked to the massive devaluation of mortgage backed securities resulting from falling real estate prices. The collapse of the "too-big to fail" banks has worsened the situation (Estay & Maurer, 2014). Considered as systematically important institutions[1], their failure caused the disruption of the broader financial system.

Besides the subprime crisis, the long series of the crises that buffeted the global economy since the 1970s has revealed the failure of the corporate governance system and has questioned the efficiency of financial reporting and its role in communicating all relevant information and in reducing information asymmetries between outside actors and insiders. According to the Association of Chartered Certified Accountants (ACCA, 2013, p. 15), "Investors' confidence in company reporting has fallen – almost 7 out of 10 investors say they have become more skeptical about information from companies since the financial crisis". Thus, an effective ERM must be equipped with an appropriate form of risk disclosure, in order to reduce the uncertainty that rose after the financial turmoil and caused the banks to be more vulnerable and exposed to risks. The lack of transparency concerning financial instruments leads investors to erroneously assess the risks related to these financial instruments.

In this context, attention dedicated to risk disclosure in annual reports of companies has increased substantially, and many academic research studies investigated this topic (see Beretta & Bozzolan, 2004; Lajili & Zéghal, 2005; Linsley & Shrives, 2006; Linsley, Shrives, & Crumpton, 2006; Abraham & Cox, 2007; Dobler, Lajili, & Zéghal, 2011; Maingot, Quon, & Zéghal, 2012; 2014; Ntim, Lindop, & Thomas, 2013; Abraham & Shrives, 2014). All of them used content analysis in order to assess the presence of risk disclosure in annual reports, but few have investigated the effect of the crisis on the quality and the volume of ERM disclosure.

Many theories support the motivation of banks to report more information about their risks especially after the crisis. On one hand, agency theory states that firms are incited to raise their risk management disclosure in order to mitigate information asymmetry problems and to avoid agency costs (Jensen & Meckling, 1976). On the other hand, following the financial crisis, banks' reputations and investor confidence have been altered. In following legitimacy and signaling theory, banks will be prompted to disclose more ERM information (Ntim et al., 2013; Abraham & Shrives, 2014). This leads us to wonder if the financial crisis has had any impact on risk management disclosure in the annual reports of the American banking firms.

The objective of this research is to investigate the effect of the subprime crisis on ERM disclosure in the annual reports of the largest US banks, and to find out its determinants.

We used a content analysis of the annual reports of 59 largest US banks for the years 2006, 2007, 2008, and 2009 to assess the volume and the quality of ERM disclosure. The volume and the quality were measured using the natural logarithm of the number of sentences containing information about ERM as in Beretta and Bozzolan (2004), Lajili and Zéghal (2005), Linsley and Shrives (2006), and a self-constructed index which was based on prior studies (Leitner-Hanetseder, 2012; Van Beest, Braam, & Boelens, 2009; Basel Committee on Banking Supervision [BCBS], 1994; 2000; 2004; Boussanni, Desrochers, & Préfontaine, 2007; Woods, Dowd, & Humphrey, 2004). We compared ERM disclosure before and after the crisis using ANOVA. Multivariate analysis was used to find out the determinants of ERM disclosure.

[1] An institution is considered as systematically important when its failure causes the failure of the entire financial system because of the domino effect. These institutions are impelled to take considerable risks.

Our main findings show that the crisis had a significant effect on the volume and the quality of ERM disclosure of the largest US banks. Additionally, the regression analysis shows that the volume and the quality of ERM disclosure are significantly and positively associated with the crisis, the size of banks, board independence, and duality. It is negatively and significantly associated with profitability, leverage, and board size.

This paper is organized as follows. Section 2 contains a review of disclosure theories and previous studies on ERM disclosure. In Section 3, we develop our hypotheses. In Section 4, we develop our research methodology. In Section 5, we present the results of the univariate and multivariate analyses and finally in Section 6, we conclude by discussing our main findings.

Review of Previous Research and Theoretical Background

Research on risk management disclosure has evolved since the publication of the second Basel Accord and its pillar 3 which lays out a set of disclosure requirements aiming at enhancing market discipline by allowing outsiders to assess the risk management process of the bank and its exposure to risks, along with the Sarbanes-Oxley Act (SOX) of 2002, which aims at improving the quality of financial reporting after a long line of scandals the financial world underwent in the 1990s and the early 2000s (AIG Assurance, Xerox, Enron, WorldCom, Tyco).

A number of these studies aimed at assessing the nature, quantity, and quality of risk disclosures and how this information is disclosed in annual reports focusing on the management discussion and analysis section.

Some studies (Linsley & Shrives, 2006; Linsley et al., 2006; Abraham & Shrives, 2014; Lajili & Zéghal, 2005) show shortcomings and a lack of transparency in risk disclosure due to the absence of standards and uniform measures for different risk components. For example, after investigating risk disclosures in a sample of TSE 300 Canadian companies, Lajili and Zéghal (2005) questioned the usefulness of such risk disclosures since they lack uniformity, clarity, and quantification.

Studies that investigated the nature of risk disclosure have reported that the disclosures are qualitative with a gap in disclosing forward-looking information (Beretta & Bozzolan, 2004; Dobler et al., 2011; Ntim et al., 2013).

Other studies investigated the factors that affect ERM disclosure when corporate specific characteristics such as company size, leverage, industry, profitability, and company risk levels are taken into account. Some researchers found that ERM disclosure is significantly associated with company size (Linsley & Shrives, 2006; Linsley et al., 2006; Abraham & Cox, 2007). Dobler et al. (2011) found that risk disclosure is positively associated with the risk measures of American and Canadian companies, and negatively associated with the risk measures of German companies while Linsley and Shrives (2006) found no relation between risk disclosure and measures of firm risk levels.

Other studies have focused on other attributes of corporate governance to explain the practice of voluntary disclosure (Abraham & Cox, 2007; Lajili, 2009). These studies suggested that firms with effective systems and processes of corporate governance are more likely to disclose discretionary information. The main findings of these studies are that the level of risk disclosure is associated with the percentage of independent directors, with leadership structure, institutional ownership, block ownership, and board size.

Under agency theory, managers will have incentives to put their self-interest above shareholders' interests and investors may be unaware of the lack of reliability of the information the managers reveal to them about the business, and in particular, about the risks it incurs and the risk management strategy implemented. This leads to an information asymmetry problem which can be reduced by a reliable and effective risk disclosure.

Signaling theory is also a good explanatory theory for risk disclosure practices. Many studies suggest that risk-related disclosure is used by companies to signal the quality and strength of their risk management processes, and their ability to identify, assess, and manage risk. An improved level of risk disclosure allows them to distinguish themselves from other companies with less effective risk management processes (Ntim et al., 2013; Abraham & Shrives, 2014).

On the other hand, Linsley and Shrives (2006) attempted to explain the risk disclosure practices of companies with lower levels of risk. Under signaling theory, they suggested that these companies might want to explain their level of risk through their superior risk management abilities and improved risk disclosure.

The assumption of litigation costs applies also perfectly to the publication of information on risk especially for the banking sector, since this sector is highly regulated and should meet the requirements of micro-prudential regulation with regards to risk management and disclosure.

Finally, legitimacy theory explains ERM disclosure practices insofar as banks are struggling to protect their image so as not to compromise further their reputation as a result of the financial crisis.

As previously discussed, most studies have investigated risk disclosure practices and the factors affecting them by using data from only one year and carrying out one year cross-sectional studies. Very few studies have investigated the practice of ERM disclosure over time using a longitudinal analysis, and especially in the period during and after the 2007/2008 global financial crisis (Ntim et al., 2013; Maingot et al., 2012; 2014).

Seeking to fill these gaps in the literature, this paper examines the effect of the crisis on ERM disclosure regarding the volume and the quality of risk-related information in the annual reports of top US banks.

Research Objective and Hypotheses to be Tested

This paper aims at examining the effect of the crisis on ERM disclosures in the annual reports of companies from the US banking sector during the period of the financial crisis from 2006 to 2009 and finding out its determinants.

The Effect of the Crisis on ERM Disclosure

The crisis increased information asymmetry between companies and investors. To reduce this information asymmetry and restore the confidence of investors, banks have an incentive to issue more voluntary information after the crisis on their risks and risk management practices. Signaling theory supports this hypothesis. Indeed, banks would be expected to publish more voluntary information including ERM following the crisis in order to enhance their reputation and show a positive image regarding their ability to manage their risks in tough periods.

Although there is not much research that directly explored the effect of the crisis on ERM disclosure by banks, some studies provide evidence on the existence of a positive effect of the crisis on ERM disclosures. Leitner-Hanetseder (2012) investigated the quality of risk information published in the annual reports of publicly traded German and Austrian companies, using a quality index. She found that the quality of risk information increases over time. Malafronte, Porzio, and Starita (2014) have examined the effect of the crisis on risk disclosure practices in insurance companies. They found that the level of risk disclosure is significantly affected by the crisis, and argued that insurance companies produce more information about the risks in times of crisis. They highlighted the importance of maintaining market confidence by relevant risk disclosure. Maingot et al. (2012) suggested that the crisis had no major impact on the disclosure of non-financial risks in Canadian companies.

Regarding the banks, they have strong incentives to increase their levels of disclosure. These incentives are tied to the desire to avoid agency costs, litigation costs, to reduce information asymmetry, and to benefit from the opportunity of a lower cost of capital with better access to liquidity markets, especially in times of economic downturn and increased uncertainty. Therefore, it is expected that the volume and the quality of ERM information will have increased after the financial crisis. Thus, we design the following hypothesis:

H1: The volume and the quality of ERM disclosure by US largest banks have increased after the 2007-2008 financial crisis.

The Determinants of ERM Disclosure

First, we are going to investigate the relation between ERM disclosure and the banking characteristics, namely, size, profitability, and the leverage level.

It has long been proven that company size is positively and significantly associated with voluntary disclosure. This is supported by legitimacy and agency theories. Bigger companies are submitted to greater political attention and more public visibility which puts them under pressure and makes them disclose more information, especially the type of information that investors and the public are interested in, such as risks and risk management information. Besides, big companies are followed by financial analysts who will require more information disclosure. In this case, companies are pushed to disclose more about their risk in order to respect the requirements of these analysts (Healy & Palepu, 2001). This is confirmed by academic studies which find a positive and significant association between risk disclosure and the size of companies (e.g., see Beretta & Bozzolan, 2004; Linsley & Shrives, 2006; Abraham & Cox, 2007).

Thus, we expected to see a positive and significant relation between the size of a bank and its ERM disclosure:

H2: The volume and the quality of both voluntary and aggregated ERM disclosures by US largest banks are positively associated with bank size.

Our third hypothesis treats the relation between ERM disclosure and leverage. High leveraged firms face higher cost of capital as demonstrated by Gebhardt, Lee, and Swaminathan (2001). In order to reduce the risk premium related to debt and hence to reduce the cost of capital, managers will be motivated to disclose more information about their risks. Based on a political costs hypothesis, Helbok and Wagner (2006) concluded that high leveraged banks raise their level of disclosure to avoid political costs. We then expect leverage to have a positive effect on ERM disclosure. Thus, we put forward the following hypothesis:

H3: The volume and the quality of both voluntary and aggregated ERM disclosures by US largest banks are positively associated with the level of leverage.

Profitability is an indicator of how well management is using the company's assets (and/or equity) in order to realize benefits. Hence, when the profitability ratio (return on asset, or return on equity) is high, this reflects a good performance, which would prevent banks from disclosing more about their risks. Helbok and Wagner (2006) stated that when the results of a company are positive, there is no need to invest in more disclosure. On the other hand, when profitability is weak, ERM disclosure is a way to reassure stakeholders. Empirical studies found a negative relation between ERM disclosure and performance measures (Malafronte et al., 2014). Thus, we make the following hypothesis:

H4: The volume and the quality of both voluntary and aggregated ERM disclosures by US largest banks are negatively associated with profitability.

The following group of hypotheses investigates the linkages between ERM disclosure and corporate governance characteristics.

Under signaling theory, managers are encouraged to disclose more information in order to provide assurance for external shareholders that they are acting in their best interest. This permits also a reduction in information asymmetry between shareholders and managers, especially when there is a high proportion of outside shareholders. Chau and Gray (2002) found a positive relation between voluntary disclosure and outside shareholders.

The duality between the role of chief executive officer (CEO) and chairman of the board is another factor that can explain banks' risk disclosure practices. When the CEO exercises the role of the chairman of the board, he will profit from his position to deliberately retain private corporate information (as suggested by agency theory). Thus, when there is duality between the role of CEO and chairman of the board, the level of ERM disclosure is low (Gul & Leung, 2004).

In the same context, board independence is a factor that can affect banks' risk disclosure practices. The role of the board of directors is mainly centered in monitoring the manager's actions. Agency theory stipulates that when the members of the board are executive members, they will not have incentives to voluntarily disclose their private information to shareholders. On the other hand, when there is a high proportion of non-executive directors in the board, they will exercise pressure on management in order to provide comprehensive and reliable disclosure especially when it comes to disclosing ERM information. Previous studies provide evidence of a positive relation between board independence and voluntary disclosures (Abraham & Cox, 2007; Lajili, 2009).

Finally, we investigated the relation between the size of the board of directors and the level of ERM disclosure. When the board of directors is small, its effectiveness will be increased since it is more cohesive and more conducive to decision-making and manager oversight (Huther, 1997). Besides, it is easier for the company to arrange board meetings for a small sized board. Previous studies support the assumption of the negative relation between board size and the level of voluntary disclosure (Jensen, 1993).

Considering the theoretical and recent empirical evidence, we formulate the following hypotheses treating the attributes of corporate governance and their relation to ERM disclosure:

H5a: The volume and the quality of both voluntary and aggregated ERM disclosures by US largest banks are positively associated with the proportion of outside shareholders.

H5b: The volume and the quality of both voluntary and aggregated ERM disclosures by US largest banks are negatively associated with the duality between the role of CEO and the chairman of the board.

H5c: The volume and the quality of both voluntary and aggregated ERM disclosures by US largest banks are positively associated with the proportion of independent non-executive directors.

H5d: The volume and the quality of both voluntary and aggregated ERM disclosures by US largest banks are negatively associated with board size.

Research Methodology

Sample Selection and Period of Investigation

This study will be based on the 100 largest[2] banks for the year 2010 according to the Federal Deposit Insurance Corporation (FDIC). The FDIC classification is made according to the criterion of the "total amount of deposits". The main source of data in our study is the annual report on the form 10-K for the years 2006, 2007, 2008, and 2009. These years have been chosen in order to cover the closest period surrounding the financial crisis that occurred in 2008 (Schroeder & Schauer, 2010) and include the period around the adoption of Statement of Financial Accounting Standards (SFAS) 157 and 159, Basel 2, and International Financial Reporting Standards (IFRS) 7 all of which came into effect in 2007. Some studies have covered such period to investigate the effect of the crisis on disclosure practices such as Magnan, Menini, and Parbonetti (2015).

Table 1

Sample Selection Procedure

	Number of dropped banks	Remaining banks
FDIC largest banks		100
Less		
Cross-listed banks	17	83
Banks mergers and acquisition	2	81
Branch banks	11	61
Availability of data for the years of 2006-2009	9	72
Non-financial parent companies	2	59

Annual reports have been downloaded from the websites of banks and the EDGAR database on the website of the American Stock Exchange (SEC). We eliminated cross-listed banks since risk disclosure may be influenced by their home country regulation, which reduced our sample to 83 banks. The financial crisis caused many banks to merge or to be acquired by other institutions (including two banks from our sample). A number of banks' branches have been eliminated in order to leave only the annual reports of the parent company (11 banks). Furthermore, we dropped nine banks with no available data. Finally, we eliminated two banks that belong to a non-financial parent company. Our final sample consists of 59 of the biggest US banks. Table 1 summarizes our sample selection process.

Thus, we conduct an empirical study on the basis of public information disclosed in the annual report (from December 31, 2006 to December 31, 2009) of a sample of 59 American banks. The number of observations amounts to 236 10-K annual reports forms.

Understanding the US Banking System

Table 2 presents the descriptive statistics of the financial characteristics of our bank sample for the four years of the study. It shows that total assets, total liabilities, equities, and deposits increased after the crisis, while net income and market capitalization decreased. We conclude that the crisis has significantly affected the financial characteristics of the banks.

[2] According to Erkens, Hung, and Matos (2012), the focus on the largest financial institutions is motivated by the attention given to big institutions especially during the 2007-2008 crisis, and by the availability and easy access to data.

Table 2

Financial Characteristics of the Banks in the Sample for the Years 2006, 2007, 2008, and 2009

Variable	Year	Minimum	Maximum	Median	Mean	SD	*N*
Total assets (000,000,000)	2006	1.262	1,196.124	16.848	96.558	250.6	59
	2007	1.296	1,318.888	20.231	113	288	58
	2008	1.493	1,746.242	22.911	132	333	58
	2009	1.347	1,627.684	21.656	133	320.3	58
Total liabilities (000,000,000)	2006	1.055	1,086.597	14.873	87.919	229.8	59
	2007	1.072	1,212.542	18.274	103	264.6	58
	2008	1.331	1,617.475	20.869	121	307.3	58
	2009	1.211	1,499.365	19.279	119	289.7	58
Total deposits (000,000,000)	2006	0.883	759.601	11.03	62.703	154.8	59
	2007	0.84	793.572	12.726	71.901	175.4	58
	2008	1.162	1,055.765	14.08	83.827	207.4	58
	2009	1.014	1,024.036	15.351	91.238	212.6	58
Total equities (000,000,000)	2006	0.207	109.526	1.557	8.639	21.05	59
	2007	0.224	108.48	2.147	10.079	23.47	58
	2008	0.162	132.838	2.23	10.907	25.94	58
	2009	0.136	166.691	2.684	13.672	31.16	58
Net income (000,000,000)	2006	0.01	15.225	0.202	1.144	2.709	59
	2007	-1.481	11.631	0.158	0.869	2.22	58
	2008	-6.215	10.419	0.119	0.326	2.07	58
	2009	-3.13	8.422	0.086	0.334	1.939	58
Debt (%)	2006	81.90	94.17	90.390	89.926	3.195	59
	2007	75.32	94.82	90.445	89.589	3.953	58
	2008	81.26	95.68	90.760	90.229	3.070	58
	2009	80.91	94.11	89.620	89.232	3.079	58
Market capitalization (000,000,000)	2006	607	273,598	6,964	28,824	56,267	52
	2007	420	183,107	5,180	22,414	40,536	54
	2008	59	124,660	2,987	13,280	25,434	53
	2009	281	164,261	3,222	19,199	36,972	53

Note. The total number of observations does not add up to the total number of disclosing firms (59 per year in the sample) in the above tests because some companies have missing observations on these variables in the database used (FDIC).

Coding of ERM Information

To analyze risk disclosure, we used the content analysis approach largely used in previous accounting studies (Beretta & Bozzolan, 2004; Maingot et al., 2012; Lajili & Zéghal, 2005) that examine qualitative information. Lajili and Zéghal (2005) stated that risk disclosure is largely and qualitatively disclosed (especially non-financial risks) and that content analysis is useful to apprehend the levels of such disclosure.

In order to measure the volume of ERM disclosure, we first used the number of sentences that contain information about risks and risk management (Beretta & Bozzolan, 2004; Linsley & Shrives, 2006). We then examined three sections in the annual reports: Item 1A Risk Factors, Management Discussion and Analysis (MD&A) and finally, the Notes to the Financial Statement.

The study of the content of ERM disclosure provided in the "Risk Factors" section "is important to regulators, investors and academic researchers as these disclosures represent 11.0 percent of the overall Form 10-K" (Campbell, Chen, Dhaliwal, Lu, & Steele, 2014, p. 397).

The MD&A section is the most important part that contains risk disclosure and many companies choose to make disclosures about their risk in this section. As noted in FR 67: "MD&A also provides a unique opportunity for management to provide investors with an understanding of its view of the, …, important trends and risks that have shaped the past or are reasonably likely to shape the future"[3].

Many studies have focused on the MD&A when analyzing ERM disclosure (Beretta & Bozzolan, 2004; Lajili & Zéghal, 2005). Finally, ERM disclosure can be found in the notes to financial statement. According to Fortin and Berthelot (2012), the disclosure of information about credit risk, interest rate, and exchange rate risks is required in the notes to financial statements.

According to Linsley and Shrives (2006, p. 388), a sentence contains risk information if we are informed of "any opportunity or prospect, or of any hazard, danger, harm, threat, or exposure, that had already impacted/or may impact upon the company, as well as the management of any such opportunity, prospect, hazard, danger, harm, threat or exposure".

We used the natural logarithm for the number of sentences to measure the volume of risk disclosure in order to minimize the effect of outliers for this variable.

Index Construction

In order to improve the robustness of our results and following the study of Ntim et al. (2013) who used both quantitative proxy (sentence count) and qualitative proxy (corporate risk disclosure index), we use a self-constructed index to measure three different levels of risk disclosures (aggregated, voluntary, and mandatory).

Our index contains 91 items (see Appendix A) from research literature and Basel Accord recommendations and even encompasses further items in order to present a comprehensive scoring model useful for the assessment of ERM disclosure in the banking sector.

We used our index to measure the quality and the volume of ERM for each risk disclosure level. To differentiate between voluntary and mandatory risk disclosures, we conducted an analysis of financial accounting regulation and Security Exchange Commissions (SEC) recommendations as well as BCBS recommendations, IFRS, and SFAS regulations.

We separated our index accordingly into 48 mandatory risk disclosure items and 43 voluntary risk disclosure items. The volume of aggregated risk disclosure is measured using an unweighted index:

$$DISI = \frac{\Sigma_{i=1}^{n} S_i}{91}$$

where S_i = The code attributed to each item which takes 1 if the item is disclosed and 0 if otherwise, n = The total number of items in the index, and 91 is the maximum unweighted score for all the items in the index.

We measured the quality of aggregated ERM disclosure using a weighted index:

$$DISQ = \frac{\Sigma_{i=1}^{n} S_i}{273}$$

[3] Retrieved from https://www.sec.gov/rules/final/33-8182.htm.

where S_i = The code attributed to each item which takes 1 if the item is disclosed in general statement, 2 if the item is disclosed in a specific statement, 3 if the item is disclosed in a specific statement containing quantitative and qualitative details, and 0 if otherwise, n = The total number of items in the index, and 273 is the maximum weighted disclosure score for all the items in the index.

The volume of voluntary risk disclosure index is measured by:

$$VOLDISI = \frac{\Sigma_{i=1}^{n} S_i}{43}$$

where S_i = The code attributed to each item which takes 1 if the item is disclosed and 0 if otherwise, n = The total number of items in the index, and 43 is the maximum unweighted score for all the items in the voluntary disclosure index.

The quality of voluntary risk disclosure index is measured by:

$$VOLDISQ = \frac{\Sigma_{i=1}^{n} S_i}{129}$$

where S_i = The code attributed to each item which takes 1 if the item is disclosed in general statement, 2 if the item is disclosed in a specific statement, 3 if the item is disclosed in a specific statement containing quantitative and qualitative details, and 0 if otherwise, n = The total number of items in the index, and 129 is the maximum weighted disclosure score for all the items in the voluntary disclosure index. While the volume of mandatory risk disclosure index is measured by:

$$MANDISI = \frac{\Sigma_{i=1}^{n} S_i}{48}$$

where S_i = The code attributed to each item which takes 1 if the item is disclosed and 0 if otherwise, n = The total number of items in the index, and 48 is the maximum unweighted score for all the items in the mandatory disclosure index.

In addition, the quality of mandatory risk disclosure index is measured by:

$$MANDISQ = \frac{\Sigma_{i=1}^{n} S_i}{144}$$

where S_i = The code attributed to each item which takes 1 if the item is disclosed in general statement, 2 if the item is disclosed in a specific statement, 3 if the item is disclosed in a specific statement containing quantitative and qualitative details, and 0 if otherwise, n = The total number of items in the index, and 144 is the maximum weighted disclosure score for all the items in the mandatory disclosure index.

In order to test the reliability of our risk disclosure index, we use Cronbach's alpha. For all the years of our study, alpha was higher than the generally accepted measure of 0.7 (0.885 in 2006, 0.895 in 2007, 0.905 in 2008, and 0.908 in 2009) indicating that our self-constructed index is reliable.

Explanatory Variables Measurement

Table 3 provides details for the measurement and sources of independent variables.

Table 3

Variable Measurement and Sources of Data

Independent variable	Measure	Code	Source
Bank size	Natural logarithm of total assets	*SIZE*	FDIC
Leverage	Total liability/total assets	*DEBT*	FDIC
Profitability	Return to assets ratio	*ROA*	FDIC
Ownership structure	Proportion of shares held by outside shareholders to total number of shares	*OUTSHARE*	Bloomberg
Duality between the role of CEO and the chairman of the board	Dummy variable which takes 1 if the chairman assumes the role of CEO and 0 if otherwise	*DUAL*	Annual report (10-K)
Board independence	The proportion of independent non-executive directors to the total number of directors	*BINDEPENDENT*	Annual report (10-K)
Board size	The number of the board members	*BSIZE*	Annual report (10-K)

In order to find the determinants of the volume and the quality of ERM disclosure, we have developed five models as follows:

Model 1:

$$LN\_DISV = \alpha_0 + \alpha_1 CRISIS + \alpha_2 SIZE + \alpha_3 DEBT + \alpha_4 ROA + \alpha_5 OUTSHARE + \alpha_6 DUAL + \alpha_7 BINDEPENDENT + \alpha_8 BSIZE + \varepsilon$$

Model 2:

$$VOLDISI = \alpha_0 + \alpha_1 CRISIS + \alpha_2 SIZE + \alpha_3 DEBT + \alpha_4 ROA + \alpha_5 OUTSHARE + \alpha_6 DUAL + \alpha_7 BINDEPENDENT + \alpha_8 BSIZE + \varepsilon \quad \text{(a)}$$

$$VOLDISQ = \alpha_0 + \alpha_1 CRISIS + \alpha_2 SIZE + \alpha_3 DEBT + \alpha_4 ROA + \alpha_5 OUTSHARE + \alpha_6 DUAL + \alpha_7 BINDEPENDENT + \alpha_8 BSIZE + \varepsilon \quad \text{(b)}$$

Model 3:

$$DISI = \alpha_0 + \alpha_1 CRISIS + \alpha_2 SIZE + \alpha_3 DEBT + \alpha_4 ROA + \alpha_5 OUTSHARE + \alpha_6 DUAL + \alpha_7 BINDEPENDENT + \alpha_8 BSIZE + \varepsilon \quad \text{(a)}$$

$$DISQ = \alpha_0 + \alpha_1 CRISIS + \alpha_2 SIZE + \alpha_3 DEBT + \alpha_4 ROA + \alpha_5 OUTSHARE + \alpha_6 DUAL + \alpha_7 BINDEPENDENT + \alpha_8 BSIZE + \varepsilon \quad \text{(b)}$$

Analysis of the Volume and the Quality of ERM Disclosure and Verification of the Effects of the Crisis

Descriptive Statistics for the Volume and the Quality of ERM Disclosure

In this section, we examine how and where US banks disclose relevant information about ERM. We measure the volume of risk disclosure by the number of sentences used in each firm's disclosure, either in Item 1A, the MD&A or footnote sections, following the content analysis approach (see Table 4).

This table shows that the mean of the volume of ERM disclosure increased after the crisis. Before the crisis, the means of *DISV* were 302.80 and 343.69 with a standard deviation of 135.479 and 157.268 in 2006 and 2007 respectively. After the crisis, this number increased to 434.41 and 484.64 with a standard deviation of 204.205 and 229.529 in 2008 and 2009 respectively. The risk disclosure in the other sections shows the same conclusion as for risk disclosure in the total annual report.

Table 4

Descriptive Statistic for ERM Disclosure

Year	Min.	Max.	Median	Mean	SD	*N*
Panel A: Volume of ERM disclosure by sentences count (*DISV*)						
Item 1A						
2006	13	280	97.00	103.44	55.552	59
2007	13	310	100.00	115.31	63.925	59
2008	14	412	145.00	161.69	76.299	59
2009	42	347	166.00	180.73	78.785	59
MD&A						
2006	40	493	156.00	162.81	99.692	59
2007	42	589	172.00	186.32	113.607	59
2008	55	760	198.00	216.85	136.888	59
2009	56	849	204.00	241.98	159.916	59
Footnotes						
2006	4	170	26.00	36.54	31.226	59
2007	7	180	33.00	42.07	35.166	59
2008	8	338	41.00	55.86	55.185	59
2009	4	286	50.00	62.10	48.045	59
Total annual report						
2006	94	652	280.00	302.80	135.479	59
2007	103	779	312.00	343.69	157.268	59
2008	133	1,050	398.00	434.41	204.205	59
2009	171	1,219	428.00	484.64	229.529	59
Panel B: Voluntary disclosure index						
Volume of ERM voluntary disclosure (*VOLDISI*)						
2006	0.378	0.911	0.60	0.622	0.152	59
2007	0.378	0.978	0.60	0.632	0.156	59
2008	0.422	0.978	0.60	0.660	0.151	59
2009	0.422	0.978	0.689	0.694	0.148	59
Quality of ERM voluntary disclosure (*VOLDISQ*)						
2006	0.193	0.570	0.326	0.347	0.0983	59
2007	0.200	0.607	0.333	0.356	0.102	59
2008	0.237	0.652	0.370	0.401	0.11	59
2009	0.244	0.681	0.4	0.423	0.110	59
Panel C: Mandatory disclosure index						
Volume of ERM mandatory disclosure (*MANDISI*)						
2006	0.222	0.63	0.426	0.428	0.105	59
2007	0.222	0.63	0.426	0.437	0.105	59
2008	0.222	0.685	0.463	0.456	0.11	59
2009	0.278	0.759	0.5	0.477	0.110	59
Quality of ERM mandatory disclosure (*MANDISQ*)						
2006	0.167	0.469	0.290	0.295	0.072	59
2007	0.167	0.469	0.302	0.303	0.075	59
2008	0.173	0.500	0.321	0.328	0.080	59
2009	0.198	0.537	0.339	0.344	0.083	59

(Table 4 continued)

Year	Min.	Max.	Median	Mean	SD	*N*
Panel D: Aggregated ERM disclosure index						
Volume of aggregated ERM disclosure index (*DISI*)						
2006	0.353	0.758	0.475	0.516	0.113	59
2007	0.364	0.788	0.495	0.526	0.116	59
2008	0.384	0.798	0.525	0.549	0.115	59
2009	0.404	0.808	0.566	0.576	0.116	59
Quality of aggregated ERM disclosure index (*DISQ*)						
2006	0.205	0.501	0.296	0.319	0.076	59
2007	0.212	0.501	0.306	0.327	0.08	59
2008	0.239	0.556	0.347	0.361	0.085	59
2009	0.249	0.576	0.374	0.380	0.088	59

Notes. *DISV*: The volume of disclosure measured by the number of sentences disclosing ERM information; Item 1A: Risk Factors section in the annual report; MD&A: Management discussion and analyses section in the annual report; Footnotes: Annexes to financial statement; T: annual report. The total of the previous three sections, $VOLDISI = \frac{\sum_{i=1}^{n} S_i}{43}$, $VOLDISQ = \frac{\sum_{i=1}^{n} S_i}{129}$, $MANDISI = \frac{\sum_{i=1}^{n} S_i}{48}$, $MANDISQ = \frac{\sum_{i=1}^{n} S_i}{144}$, $DISI = \frac{\sum_{i=1}^{n} S_i}{103}$, $DISQ = \frac{\sum_{i=1}^{n} S_i}{309}$.

We also conclude that ERM information is mainly disclosed in the MD&A section followed by the risk factor section and, to a lesser extent, in the footnotes.

Panel B shows that, the quality and the volume of voluntary ERM disclosure have increased through the four years of investigation (62.2% in 2006, 63.2% in 2007, 66.0% in 2008, and 69.4% in 2009).

Similarly, the mean of the quality of ERM voluntary disclosure index has increased from 34.7% and 35.6% during 2006 and 2007 respectively to 40.1% and 42.3% during 2008 and 2009 respectively.

Panel C that presents the descriptive statistics of mandatory disclosure index exhibits the same trend as panel B. The mean of the volume of ERM mandatory disclosure index has increased from 42.8% and 43.7% during 2006 and 2007 respectively to 45.6% and 47.7% during 2008 and 2009 respectively. Similarly, the mean of the quality of ERM mandatory disclosure index has increased from 29.5% and 30.3% during 2006 and 2007 respectively to 32.8% and 34.4% during 2008 and 2009 respectively.

Finally, panel D shows that the volume of aggregated ERM disclosure index (*DISI*) has increased from 2006 to 2009 with a mean of 51.6% and 52.6% in 2006 and 2007 respectively to 54.9% and 57.6% in 2008 and 2009 respectively. Panel D also shows that the quality of aggregated ERM disclosure index (*DISQ*) has increased from 2006 to 2009 with a mean of 31.9% and 32.7% in 2006 and 2007 respectively to 36.1% and 38.0% in 2008 and 2009 respectively. These results suggest that the crisis has affected the volume and the quality of the ERM disclosure in the annual report of the top US banks supporting our first hypothesis.

Test for the Hypotheses Concerning the Effect of the Crisis on the Volume and the Quality of ERM Disclosure

To further investigate the effect of the crisis on the volume and the quality of ERM disclosure, we conducted an ANOVA analysis for the seven measures of ERM disclosure after gathering the data from the four years of the study. *DISV*, *VOLDISI*, *VOLDISQ*, *MANDISI*, *MANDISQ*, *DISI*, and *DISQ* constitute the dependent list of variables and *CRISIS* is the independent factor affecting these variables.

The hypotheses to be tested are the following:

The null hypothesis is that the crisis has no effect on the volume and the quality of ERM disclosure:

H_0: $DISV_0 = DISV_1$; $VOLDISI_0 = VOLDISI_1$; $VOLDISQ_0 = VOLDISQ_1$; $MANDISI_0 = MANDISI_1$; $MANDISQ_0 = MANDISQ_1$; $DISI_0 = DISI_1$; $DISQ_0 = DISQ_1$.

The alternative hypothesis:

H_0^c: $DISV_0 \neq DISV_1$; $VOLDISI_0 \neq VOLDISI_1$; $VOLDISQ_0 \neq VOLDISQ_1$; $MANDISI_0 \neq MANDISI_1$; $MANDISQ_0 \neq MANDISQ_1$; $DISI_0 \neq DISI_1$; $DISQ_0 \neq DISQ_1$.

More specifically:

H_1: $DISV_1 > DISV_0$; $VOLDISI_1 > VOLDISI_0$; $VOLDISQ_1 > VOLDISQ_0$; $MANDISI_1 > MANDISI_0$; $MANDISQ_1 > MANDISQ_0$; $DISI_1 > DISI_0$; $DISQ_1 > DISQ_0$, in which the crisis has a positive effect on the volume and the quality of both mandatory and voluntary ERM disclosures.

Table 5

Results of Variance Analysis for the Volume and Quality of Both Voluntary and Mandatory Disclosures According to the Crisis Period Effect Measured Using a Dummy Variable

Group identification	Number of observations	Mean *DISV* (SD)	Mean *VOLDISI* (SD)	Mean *VOLDISQ* (SD)	Mean *MANDISI* (SD)	Mean *MANDISQ* (SD)	Mean *DISI* (SD)	Mean *DISQ* (SD)
Before the crisis	118	323.25 (147.585)	0.655 (0.378)	0.352 (0.099)	0.432 (0.104)	0.299 (0.074)	0.521 (0.114)	0.323 (0.077)
After the crisis	118	459.53 (217.772)	(0.705) (0.422)	0.412 (0.110)	0.467 (0.110)	0.336 (0.081)	0.562 (0.116)	0.371 (0.086)
Total firms	236	391.39	0.672 (0.378)	0.382 (0.109)	0.449 (0.108)	0.318 (0.08)	0.542 (0.117)	0.347 (0.085)
Value of *F*		31.667	6.445	19.340	6.045	13.276	7.691	19.700
Significance level		0.000	0.012	0.000	0.015	0.000	0.006	0.000

Notes. *DISV*: Disclosure volume measured by the number of sentences disclosing ERM information; $VOLDISI = \frac{\sum_{i=1}^{n} S_i}{43}$, $VOLDISQ = \frac{\sum_{i=1}^{n} S_i}{129}$, $MANDISI = \frac{\sum_{i=1}^{n} S_i}{48}$, $MANDISQ = \frac{\sum_{i=1}^{n} S_i}{144}$, $DISI = \frac{\sum_{i=1}^{n} S_i}{103}$, $DISQ = \frac{\sum_{i=1}^{n} S_i}{309}$.

The results of the analysis of variance are reported in Table 5. The means of *DISV*, *VOLDISI*, *VOLDISQ*, *MANDISI*, *MANDISQ*, *DISI*, and *DISQ* for the period before and after the crisis and the related *F* statistics are summarized in the last three columns. The *F* values of the volume of risk disclosure measured by the number of sentences and for the volume and the quality of aggregated, voluntary, and mandatory ERM disclosure are highly significant. Thus, the effect of the crisis on ERM disclosure is significant and the null hypothesis is rejected. On the other hand, the means of *DISV*, *VOLDISI*, *VOLDISQ*, *MANDISI*, *MANDISQ*, *DISI*, and *DISQ* have increased after the crisis which means that the crisis has a positive and significant effect on ERM disclosure volume and quality which is consistent with our first hypothesis.

Multivariate Analysis for the Effect of the Crisis on ERM Disclosure and Its Determinants

In this section, we analyze the determinants of ERM disclosure during the financial crisis. The descriptive statistics for these variables are presented in Table 6. This table shows no changes in the variables *SIZE* and *DEBT* as well as in the corporate governance variables. However, the variable *ROA* decreased from 0.012 before the crisis to 0.001 after the crisis.

Table 6

Descriptive Analysis of Accounting Measures of Risks, Firm Characteristics, and Corporate Governance Variables Before and After the Crisis

Variable	Period	Min.	Max.	Mean	Median	SD	*N*
SIZE	2006/07	0.2328	7.1845	3.2768	2.9511	1.4560	117
	2008/09	0.2980	7.4652	3.5884	3.1032	1.4293	116
DEBT	2006/07	0.7532	0.9482	0.8976	0.9040	0.0358	117
	2008/09	0.8091	0.9568	0.8973	0.9013	0.0310	116
ROA	2006/07	-0.0280	0.0890	0.0125	0.0115	0.0111	117
	2008/09	-0.1288	0.0365	0.0012	0.0055	0.0184	115
OUTSHARE	2006/07	0.8392	1.0836	0.9965	0.9998	0.0343	106
	2008/09	0.0007	1.1487	0.9827	0.9991	0.1045	108
DUAL	2006/07	0	1	0.66	1	0.477	116
	2008/09	0	1	0.66	1	0.477	116
BINDEPENDENT	2006/07	0.7500	1	0.9032	0.9167	0.0471	113
	2008/09	0.7778	1	0.9075	0.9167	0.0401	118
BSIZE	2006/07	7	21	13.38	13.00	3.083	116
	2008/09	6	21	12.79	12.00	2.805	116

Notes. *SIZE*: Natural logarithm of total asset; *DEBT*: Total liability/total asset; *ROA*: Return to asset ratio; *OUTSHARE*: Proportion of shares held by outside shareholders to total number of shares; *DUAL*: Dummy variable which takes 1 if the chairman assumes the role of CEO and 0 if otherwise; *BINDEPENDENT*: The proportion of independent non-executive directors to the total number of directors; *BSIZE*: The number of the board members.

The results of the Pearson correlation. Table 7 presents the Pearson correlation coefficients between all the variables of our study and their statistical significance. The Pearson correlation shows that the crisis is significantly ($p < 0.05$) and positively correlated with the volume and the quality of ERM disclosure.

Thus, H1 which predicted a positive effect of the crisis on ERM disclosure is fully supported.

H2 (positive effect of the bank size), H3 (positive effect of the leverage), H4 (negative effect of the profitability), and H5c (positive effect of the board independence) are supported by the correlation matrix. Nevertheless, the association is only significant for *SIZE*, *ROA*, and *BINDEPENDENT*.

Table 7

Correlation Matrix for All Variables

Variable	*LN_DISV*	*VOLDISI*	*VOLDISQ*	*DISI*	*DISQ*	*CRISIS*	*SIZE*	*DEBT*	*ROA*	*DUAL*	*BIND.*	*BSIZE*	*OUT.*
LN_DISV	1												
VOLDISI	0.481**	1											
VOLDISQ	0.562**	0.933**	1										
DISI	0.584**	0.920**	0.885**	1									
DISQ	0.641**	0.877**	0.928**	0.958**	1								
CRISIS	0.357**	0.164*	0.276**	0.178**	0.279**	1							
SIZE	0.647**	0.442**	0.471**	0.530**	0.544**	0.108	1						
DEBT	0.073	0.135*	0.141*	0.102	0.079	-0.004	0.173**	1					
ROA	-0.267**	-0.140*	-0.164*	-0.133*	-0.174**	-0.352**	0.028	-0.020	1				
DUAL	0.019	0.069	0.103	0.107	0.128	0.000	0.106	-0.013	-0.002	1			
BIND.	0.134*	0.211**	0.195**	0.190**	0.186**	0.050	0.258**	0.011	0.029	-0.167*	1		
BSIZE	0.067	0.065	0.045	0.078	0.077	-0.099	0.222**	0.080	0.045	0.012	0.385**	1	
OUT.	-0.009	-0.012	-0.066	0.004	-0.040	-0.088	0.015	-0.029	0.022	0.075	-0.110	-0.149*	1

Note. **: Correlation is significant at the 0.01 level (2-tailed); *: Correlation is significant at the 0.05 level (2-tailed).

The results of the regression analysis. Before proceeding to the regression between the volume and the quality of the disclosure of information on the ERM and the variables related to the characteristics of the banks and the corporate governance attributes, we measure the variance inflation factor (VIF) in order to detect if there is a multicollinearity problem between the independent variables. In our study, the VIF is lower than 2 for all the variables which means that there is no multicollinearity between variables (Myers, 1990).

Table 8 presents the results of the regression analysis. This table shows that the crisis has a significant and positive effect on ERM levels of disclosure as measured by *LN_DISV* (p = 0.000) as well as in the quality of voluntary and aggregate ERM disclosure as measured by *VOLDISQ* and *DISQ* (p = 0.003 and 0.002 respectively). Nevertheless, this effect is not significant on the volume of voluntary and aggregate ERM disclosure measured by *VOLDISI* and *DISI*. This means that the crisis has affected the quality but not the volume of ERM disclosure. Indeed, the variable *LN_DISV* is measured by the number of sentences containing information about ERM. The effect of the crisis on this does not distinguish between the quality and volume of ERM disclosure since the increase in the number of sentences may mean improving the quality of the information that contains more detailed quantitative and qualitative information about the various risks and ERM disclosed. By measuring separately the volume (*DISI*) and the quality (*DISQ*) of ERM disclosure, we note that the crisis has affected the quality of risk disclosure but not the volume. The quality of risk disclosure is measured using the same list of items that is used for the volume and the crisis affected the way these items are disclosed and proved that the same categories of risk information are disclosed with more specific details. With regards to the determinants of the ERM disclosure, the results of the regression analysis show a positive and significant relation between *SIZE* and ERM disclosure (p = 0.000) for all the proxies of ERM disclosure which is consistent with our H2 and previous research (Beretta & Bozzolan, 2004; Dobler et al., 2011; Linsley & Shrives, 2006; Abraham & Cox, 2007). Results concerning *DEBT* are inconclusive. We found that the relation between debt and risk disclosure is only significant when the regression is conducted for *LN_DISV* (Model 1) which refutes our hypothesis H3 that "The volume and the quality of both voluntary and aggregated ERM disclosures by US largest banks are positively associated with the level of leverage". This result is consistent with Eng and Mak (2003), but inconsistent with most of prior research investigating the determinants of voluntary disclosure (Gebhardt et al., 2001; Helbok & Wagner, 2006) and enunciates that high leveraged banks disclose less ERM information during the financial crisis. This finding suggests that high leveraged banks do not want to incur further expenses related to the disclosure of more information about their risks.

The negative and significant relation between the profitability ratio and the level of ERM disclosure measured by "*LN_DISV*" confirms our hypothesis H4.

Duality is positively and significantly associated with the quality of ERM voluntary disclosure and the volume and quality of aggregated risk disclosure (Models 2b and 3a-b). This finding is not consistent with our hypothesis H5b. It seems that when the CEO exercises the role of the chairman of the board, banks disclose more ERM information since he is responsible for disclosing all relevant information especially about risks in order to avoid litigation costs and potential lawsuits against him.

As envisaged in our hypothesis H5c, the regression shows that the volume and the quality of ERM disclosure are positively and significantly associated with the board independence (Models 2a-b and 3a-b). This finding is consistent with previous studies (Abraham & Cox, 2007; Lajili, 2009). Finally, the board size is negatively and significantly associated with the quality of ERM voluntary disclosure (Model 2b). This is consistent with our H5d and previous studies (Jensen, 1993).

Table 8

Results of the Regression Analysis Between the Volume and the Quality of ERM Disclosure and the Crisis, Banks Specific Characteristics, and Corporate Governance Characteristics

Model	Model 1		Model 2a		Model 2b		Model 3a		Model 3b		VIF
	LN_DISV		*VOLDISI*		*VOLDISQ*		*DISI*		*DISQ*		
	B	*t*	B	*t*	B	*t*	B	*t*	B	*t*	
(Constant)	3.822	4.606 0.000	-0.739	-2.053 0.041	-0.516	-2.141 0.033	-0.357	-1.382 0.169	-0.213	-1.173 0.242	
CRISIS	0.225	4.675 0.000***	0.023	0.274	0.042	2.971 0.003**	0.023	1.504 0.134	0.033	3.090 0.002**	1.178
SIZE	0.488	13.125 0.000***	0.088	5.437 0.000***	0.066	6.158 0.000***	0.085	7.365 0.000***	0.064	7.830 0.000***	1.171
DEBT	-1.374	-2.026 0.044**	0.185	0.629 0.530	0.093	0.471 0.638	-0.041	-0.193 0.847	-0.110	-0.744 0.457	1.021
ROA	-4.798	-3.323 0.001*	-0.824	-1.315 0.190	-0.498	-1.187 0.236	-0.486	-1.081 0.281	-0.424	-1.344 0.180	1.144
OUTSHARE	-0.096	-0.332 0.740	-0.037	-0.292 0.771	-0.101	-1.203 0.230	-0.014	-0.156 0.876	-0.050	-0.788 0.432	1.052
DUAL	0.024	0.502 0.616	0.030	1.421 0.157	0.030	2.140 0.034*	0.032	2.159 0.032*	0.027	2.521 0.012*	1.081
BINDEPENDENT	-0.209	-0.356 0.722	0.736	2.890 0.004**	0.506	2.967 0.003**	0.372	2.033 0.043*	0.265	2.064 0.040*	1.335
BSIZE	-0.013	-1.574 0.117	-0.006	-1.705 0.090	-0.006	-2.281 0.024*	-0.004	-1.491 0.138	-0.003	-1.493 0.137	1.264
R^2		0.565		0.238		0.317		0.312		0.371	
R^2 adjusted		0.547		0.208		0.290		0.285		0.346	
F		32.427 0.000		7.821 0.000		11.600 0.000		11.358 0.000		14.728 0.000	

Notes. *: Significant at the level of 5%; **: Significant at the level of 1%; ***: Significant at the level of 0.1%. *LN_DISV*: Natural logarithm of the number of sentences containing ERM information; *DISI*: Disclosure volume = $\frac{\sum_{i=1}^{n} S_i}{103}$ (with S_i = The code attributed to each item which takes 1 if the item is disclosed and 0 if otherwise, and n = The total number of items in the index); *DISQ*: Disclosure quality = $\frac{\sum_{i=1}^{n} S_i}{309}$ (with S_i = The code attributed to each item which takes 1 if the item is disclosed in a general statement, 2 if the item is disclosed in a specific statement, 3 if the item is disclosed in a specific statement containing quantitative and qualitative details, and 0 if otherwise, and n = The total number of items in the index); *CRISIS*: Dummy variable which takes 1 for the period after the crisis and 0 for the period before the crisis; *SIZE*: Natural logarithm of total asset; *DEBT*: Total liability/total asset; *ROA*: Return to asset ratio; *OUTSHARE*: Proportion of shares held by outside shareholders to total number of shares; *DUAL*: Dummy variable which takes 1 if the chairman assumes the role of CEO and 0 if otherwise; *BINDEPENDENT*: The proportion of independent non-executive directors to the total number of directors; *BSIZE*: The number of the board members.

Conclusion

This research provides evidence regarding the impact of the crisis on the volume and the quality of ERM disclosure in the largest US banks. We first calculated the volume and the quality of voluntary, mandatory, and aggregated ERM disclosure using a self-constructed index, and then compared the scores using an ANOVA analysis to detect the effect of the crisis. Second, we used a multivariate analysis incorporating the variable crisis among the factors affecting the practice of risk disclosure.

The crisis has a positive and significant effect on the quality of voluntary and aggregated risk disclosure. Our research sheds new lights on the importance of improving the quality of ERM disclosure especially in times of crisis. Many factors have contributed to the increase in the level of ERM disclosure. Banks may have

wanted to signal their success in overcoming the threat of bankruptcy after the financial meltdown, and gave more importance to the disclosure of their ERM information. Besides, the number of risks increased after the financial crisis which led banks to voluntarily disclose more information to explain the actions they are taking in order to mitigate those risks, and to reassure investors and depositors that they are out of danger so as to restore public trust.

Further, litigation costs can explain the reason why banks are making public the information about the dramatic situation they are facing. The financial crisis created a debate about who to blame and regulators were pointing fingers at banks and looking for answers in their annual reports.

Critical factors affecting ERM disclosure in a crisis context have been analyzed. We found that banks' size has a positive and significant association with ERM disclosure. The size of the banks can be considered as a proof of political visibility which could push the managers to increase their voluntary risk disclosure strategy to avoid political and litigation costs. Contrary to previous studies and our expectations, we found a negative and significant association between leverage and ERM disclosure during the period of the crisis when ERM disclosure is calculated by the natural logarithm of the number of sentences containing ERM information. This finding is consistent with the study of Eng and Mak (2003) and demonstrates that in period of crisis, low leveraged banks disclose more information about their risks. Banks might want to signal their capital structure characterized by a low leverage ratio in order to decrease their cost of capital and have better access to funds.

Profitability is another determinant of risk disclosure. We found that a high level of profitability ratio as measured by *ROA* is negatively and significantly associated with the level of risk disclosure. Banks with high performance do not feel the need to invest in more ERM disclosure (Helbok & Wagner, 2006).

Finally, we found a positive (negative) and significant relationship between the volume and quality of ERM disclosure and duality as well as independent members of the board of director (board size) which supports our expectations and previous studies (Abraham & Cox, 2007; Lajili, 2009).

Our research has implications for regulators and standards setters by highlighting the importance of disclosing all reliable information about risks during the financial crisis. Regulatory responses and measures taken to mitigate risks and assure financial stability are always lagging behind the fast growth of financial innovation. Accordingly, solutions for crises should be taken ex-ante through prediction models and an improvement of the quality of financial reporting related to ERM and especially to financial instruments in order to allow investors and financial analysts to better assess banks' risks and take appropriate actions in a timely manner, rather than through an ex-post new set of rules. We also contributed to the literature by providing a comprehensive index to measure the volume and the quality of ERM disclosure by gathering a list of items based on the recommendations of the Basel report and a review of previous research and adapting them to risk management disclosure in a banking context. Thus, it would be interesting for future studies to use this index to an extended sample of banks from different countries to see if the crisis has affected risk disclosures in their annual reports and if the same relations will be found between ERM disclosure and banks' characteristics and corporate governance attributes.

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Appendix A

The common scale used to measure the weighted index of the most of the items, except for the three first items of the first category and the entire second category containing the qualitative characteristics of the information (presented in Table A1 below), is the following:

0: The item is not disclosed;

1: The item is disclosed in a general statement;

2: The item is disclosed in a specific statement;

3: The item is disclosed in a specific statement containing quantitative and qualitative details.

Table A1

Coding Sheet Used to Measure the Index of Quality of the ERM Disclosures With the Measurement Scales

Item	Code	Mandatory/voluntary
General items about overall risk		
1. Is the risk report disclosed in a self-contained section in the three locations in the annual report (risk report, MD&A, and notes to financial statement) and is the risk report marked by a headline and table of content?	0: Risk report is not in a self-contained section 1: Risk report is in a self-contained section but not marked by a headline 2: Not all locations in the annual report contain a risk report marked by a headline 3: Risk report is in a self-contained section marked by a headline in all locations of the annual report	Voluntary
2. Are risks separated into adequate categories and types?	0: Risks are not separated into adequate categories and types 1: Categories of risk are disclosed in a general statement 2: Categories of risk are disclosed in a specific statement 3: Categories of risk are disclosed in a specific statement containing quantitative and qualitative details	Voluntary
3. Does the risk report include a definition of risk and risk management?		Voluntary

(Table A1 continued)

Item	Code	Mandatory/voluntary
General items about overall risk		
4. Does the risk report include the objectives and the strategy to achieve the objectives?		Voluntary
5. Is there a description of the integrated risk management procedure?		Voluntary
6. Does the risk report contain information about the company's implementation of risk management?		
6.1. Risk tolerance		Voluntary
6.2. Risk governance		Voluntary
6.3. Competence and infrastructure of the ERM		Voluntary
7. Are there any disclosures concerning the tasks of risk management and the internal review process (quality verification)?		Voluntary
8. Does the risk report contain any possible failure of the risk management process?		Voluntary
9. Does the risk report explain materiality in context to risks?		Voluntary
10. Is there any information about the existence of a chief risk officer and its role?		Voluntary
11. Does the risk report include a general statement about the risk situation of the group?		Voluntary
Qualitative characteristic of the information		
12. To what extent does the presence of the forward-looking statement in the risk report help in forming expectations and predictions concerning the future of the company?	0 = No forward-looking information 1 = Forward-looking information not a separate subsection 2 = Separate subsection 3 = Extensive predictions useful for making predictions	Voluntary
13. To what extent does the presence of non-financial information in terms of business opportunities and risks complement the financial information?	0 = No non-financial information 1 = Little non-financial information, not useful for forming expectations 2 = Useful non-financial information 3 = Non-financial information presents additional information which helps develop expectations	Voluntary
14. To what extent does the risk management report provide feedback to users of the annual report as to how various market events and significant transactions affected the bank?	0 = No feedback 1 = Little feedback on the past (feedback in general terms) 2 = Feedback is present (feedback in specific terms) 3 = Comprehensive feedback helps understanding of how events and transactions influenced the company	Voluntary
15. To what extent are valid arguments provided to support the decision for certain assumptions and estimates in the risk management report?	0 = No arguments provided 1 = General explanation 2 = Specific explanation of estimations 3 = Comprehensive explanation, formulas explained	Voluntary
16. To what extent does the company base its choice for certain accounting principles on valid arguments?	0 = Changes not explained 1 = Minimum explanation (general) 2 = Explained why (specific) 3 = Explained why + consequences	Voluntary
17. To what extent does the company, in the discussion of the annual results, highlight the positive events as well as the negative events?	0 = Negative events only mentioned in footnotes (or no negative events) 1 = Emphasis on positive events (negative events in general) 2 = Emphasis on positive events, but negative events are mentioned; no negative events occurred 3 = Both positive/negative events are explained and their impact	Voluntary

(Table A1 continued)

Item	Code	Mandatory/voluntary
Qualitative characteristic of the information		
18. To what extent are the notes to the balance sheet and the income statement sufficiently clear?	0 = No explanation 1 = Very short description, difficult to understand (general explanation) 2 = Specific explanation that describes what happens 3 = Terms are explained (which assumptions, etc.) and everything that might be difficult to understand is explained	Voluntary
19. To what extent does the presence of graphs and tables clarify the presented information?	0 = No graphs 1 = 1-2 graphs 2 = 3-5 graphs 3 = > 6 graphs	Voluntary
20. To what extent is the use of language and technical jargon in the annual report easy to follow?	0 = Much jargon (industry), not explained 1 = Much jargon, minimal explanation 2 = Jargon is explained in text/glossary 3 = Not much jargon, or well explained	Voluntary
21. What is the size of the glossary?	0 = No glossary 1 = 1-2 pages 2 = 2-3 pages 3 = > 3 pages	Voluntary
22. To what extent do the notes to changes in accounting policies explain the implications of the change?	0 = Changes not explained or no changes 1 = Minimum explanation 2 = Explained why 3 = Explained why + consequences	Voluntary
23. To what extent do the notes to revisions in accounting estimates and judgments explain the implications of the revision?	0 = Revision without notes 1 = Revision with few notes 2 = No revision/clear notes 3 = Comprehensive notes + implications (past)	Voluntary
24. To what extent did the company adjust previous accounting period's figures, for the effect of the implementation of a change in accounting policy or revisions in accounting estimates?	0 = No adjustments 1 = Described adjustments 2 = Actual adjustments (one year) 3 = > 2 years + notes	Voluntary
25. To what extent does the company provide a comparison of the results of the current accounting period with previous accounting periods in the risk management report?	0 = No comparison 1 = Only with previous year 2 = With 2-5 years 3 = More than 5 years + description of implications	Voluntary
26. To what extent does the company present financial index numbers and ratios in the risk management report?	0 = No ratios 1 = 1-2 ratios 2 = 3-10 ratios 3 = > 10 ratios	Voluntary
Credit risk		
27. Does the risk report include a definition of credit risk?		Voluntary
28. Does the bank disclose information about the accounting policies, practices, and methods it uses to account for its credit risk exposures?		Mandatory
29. Does the bank disclose accounting policies and methods used to determine specific and general allowances as well as assumptions used?		Mandatory

(Table A1 continued)

Item	Code	Mandatory/voluntary
Credit risk		
30. Does the risk report include information about the activities that generate credit risk (sources of credit risk)?		Mandatory
31. Does the risk report include information on the management, structure, and organization of the credit risk management function?		Mandatory
32. Does the risk report include qualitative information on the credit risk management and control policies and practices?		Mandatory
33. Does the bank disclose information on its techniques and methods for managing past due and impaired assets?		Mandatory
34. Does the bank provide information on its use of credit scoring and portfolio credit risk measurement models?		Mandatory
35. Does the bank disclose balances of credit exposures, including current exposure and, where applicable, future potential exposure by major categories?		Mandatory
36.1. Information about credit exposures by business line.		Mandatory
36.2. Information about credit exposures by major categories of counterparties.		Mandatory
36.3. Information about credit exposures by geographic areas.		Mandatory
37. Does the bank disclose information about significant concentrations of credit risk?		Mandatory
38. Does the bank disclose the effect of credit risk mitigation techniques, including collateral, guarantees, credit insurance, and legally enforceable netting agreements?		Mandatory
39. Does the bank disclose quantitative and qualitative information about its use of credit derivatives and other instruments that reallocate credit risk?		Mandatory
40. Does the bank disclose quantitative and qualitative information about its securitization activities?		Mandatory
41. Does the bank disclose summary information about its contractual obligations with respect to recourse arrangements and the expected losses under those arrangements?		Mandatory
42. Does the bank provide summary information about its internal rating process and the internal credit ratings of its credit exposures?		Mandatory
43. Does the bank disclose total credit exposures by major asset category showing impaired and past due amounts relating to each category?		Mandatory
44. Does the bank disclose the amounts of specific, general, and other allowances established against each major asset category?		Mandatory
45. Does the bank disclose a reconciliation of changes in the allowances for credit impairment?		Mandatory
46. Does the bank disclose summary information about credit exposures that have been restructured during the year?		Mandatory
47. Does the bank provide information on revenues, net earnings, and return on assets?		Mandatory
Liquidity risk		
48. Does the risk report include a definition of liquidity risk?		Voluntary
49. Does the risk report include a definition of liquidity risk management and its goal?		Voluntary
50. Does the liquidity risk management report include information about the sources of liquidity risk?		Voluntary
51. Does the liquidity risk management report information on the management, structure, and organization of its liquidity risk management function?		Voluntary
52. Does the bank disclose qualitative information on its liquidity risk management and control policies and practices?		Voluntary
53. Does the bank provide details on key metrics used in their analyses and on the types of stress tests they perform?		Mandatory
54. Does the bank provide details on contingency planning?		Mandatory
55. Does the bank provide details about the role of supervisors?		Mandatory
56. Does the bank provide details on the coverage of the four origins of cash flows: assets, liabilities, off-balance-sheet activities, sources and uses of funds?		Mandatory
57. Does the bank report information about cash available from the sale or maturity of assets or their use as collateral for secured borrowing (i.e., asset liquidity), including the assumptions on what prices these assets would fetch in the postulated scenario (proceeds from sale)?		Mandatory
58. Does the bank report information about funding requirements from liabilities?		Mandatory

(Table A1 continued)

Item	Code	Mandatory/voluntary
Liquidity risk		
59. Does the risk report include information about debt maturities, including put options and the effect of acceleration clauses?		Mandatory
60. Does the risk report include information about cash flows from operations, focusing on trends and indicating whether potential funding demand from commitments and contingencies is included in the data?		Mandatory
61. Does the risk report include information about the potential need for cash transfers between the group's affiliates and its ability to effect the transfers?		Mandatory
62. Does the risk report include information about the reliability of alternative funding sources?		Mandatory
63. Does the risk report include information about derivatives used to manage liquidity risk?		Mandatory
64. Does the risk report include information about liquidity risks from derivatives?		Mandatory
Market risk		
65. Does the risk report include a definition of market risk?		Voluntary
66. Does the bank disclose market risk management objectives and policies?		Voluntary
67. Does the market risk management report information on the management, structure, and organization of its market risk management function?		Voluntary
68. Does the bank disclose qualitative information on its market risk management and control policies and practices? Monitoring?		Voluntary
69. Does the bank disclose the type of hedging instrument used to minimize market risks?		Mandatory
70. Does the bank provide additional voluntary disclosure on other market risks?		Voluntary
71. Does the risk report contain quantitative and qualitative disclosures about the bank's measures of risk?		Mandatory
72. Does the risk report include effect of changes in market prices, interest rates, and exchange rates on the value of the portfolio?		Mandatory
73. Does the bank use a portfolio approach when identifying market risk?		Mandatory
74. Does the bank have a focus on basic types of risks (interest rate risk, exchange rate risk) rather than on instruments or balance sheet categories?		Mandatory
75. Does the risk report contain a measure of the value of the portfolio that reflects current market prices, interest rates, and exchange rates?		Mandatory
76. Does the risk report contain a measure of the sensitivity of the portfolio's value to changes in these prices?		Mandatory
77. Does the bank explain the objective of the chosen method (of measurement) and its limitations?		Voluntary
78. Does the bank give reasons for changes in the reported level of market risk since the last reporting date?		Voluntary
79. Does the risk report include gap analysis of interest rate re-pricing and/or maturity dates?		Mandatory
80. Does the bank report any information about the duration of debt instruments?		Mandatory
Operational risk		
81. Does the risk report include a definition of operational risk?		Voluntary
82. Does the risk report include information about categories of operational risk events?		Voluntary
83. Does the bank report qualitative information on its operational risk management and control policies and practices?		Mandatory
84. Does the operational risk management report information on the operational risk management function?		Mandatory
85. Does the bank provide information about operational risk exposure (by business line if available)?		Mandatory
86. Does the bank provide information on the model used to manage operational risk?		Mandatory
87. Does the bank provide information on unexpected loss from operational risk?		Mandatory