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The Influence of Corporate Governance on Financial Derivatives Decisions

(Pengaruh Tadbir Urus Korporat Terhadap Keputusan Derivatif Kewangan)

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ABSTRACT

This study investigates corporate governance risk behavior around the financial crises period and its sensitivity to varying levels of financial constraints. The study employs simultaneous-equations methodology to examine firms' capital structure and derivatives usage decisions simultaneously. The sample is split into high and low levels of financial risk to examine impacts of corporate governance on decisions regarding usage of derivatives under both conditions. Further, quantile analysis is preformed to investigate governance responses at different levels of risk. We observe that corporate governance responses vary with the levels of distress. At lower levels, insider shareholders, Chief Executive Officer (CEO) salary, and CEO age influence financial derivatives decisions. However, institutional shareholders, audit committee meetings, CEO bonus and other compensation consistently impact derivatives decisions, irrespective of the level of financial distress. The study suggests that governance mechanisms vary with financial distress levels. Firms could optimally structure their governance mechanisms accordingly. The study shows it is important to incorporate levels of risk in any corporate governance study.

Keywords: Financial Derivatives; corporate governance; financial distress
JEL: G3, G31, G32

ABSTRAK

Kajian ini menyiasat gelagat risiko tadbir urus korporat sekitar tempoh krisis kewangan dan sensitivitinya terhadap pelbagai tahap kekangan kewangan. Kajian ini menggunakan metodologi persamaan serentak untuk mengkaji struktur modal firma dan keputusan penggunaan derivatif secara serentak. Sampel dibahagikan kepada tahap risiko kewangan yang tinggi dan rendah untuk mengkaji kesan tadbir urus korporat ke atas keputusan mengenai penggunaan derivatif di bawah kedua-dua syarat. Selanjutnya, analisis kuantil dibentuk terlebih dahulu untuk menyiasat tindak balas tadbir urus pada tahap risiko yang berbeza. Kami mendapati bahawa tindak balas tadbir urus korporat berbeza-beza mengikut tahap kesulitan. Di peringkat rendah, pemegang saham orang dalam, gaji Ketua Pegawai Eksekutif (KPE) dan umur KPE mempengaruhi keputusan derivatif kewangan. Walau bagaimanapun, pemegang saham institusi, mesyuarat jawatankuasa audit, bonus KPE dan pampasan lain secara konsisten memberi kesan kepada keputusan derivatif, tanpa mengira tahap kesulitan kewangan. Kajian itu mencadangkan bahawa mekanisme tadbir urus berbeza mengikut tahap kesulitan kewangan. Firma boleh menstruktur mekanisme tadbir urus mereka secara optimum. Kajian itu menunjukkan adalah penting untuk melibatkan tahap risiko dalam mana-mana kajian tadbir urus korporat.

Kata kunci: Derivatif kewangan; tadbir urus korporat; tekanan kewangan
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INTRODUCTION

Firms tend to use financial derivatives to increase their debt capacity and smoothen cash flows, leading to a lower reliance on external financing and related higher interest costs. Extant literature shows that financial concerns drive derivatives decisions, and hedging reduces financial distress for the firm (Haushalter 2000; Mayers & Smith 1982; Graham & Rogers 2002; Dolde 1995; Gay & Nam 1998; Nguyen & Faff 2002). Therefore, managements rely on derivatives to reduce risks.

This study examines whether corporate governance risk behavior varies with the consideration of different levels of financial constraints. Normally, corporate governance plays a less active role and is less concerned with risk at lower levels of distress or becomes ineffective and reticent when there is the need to take any action at higher levels of financial distress. On the other hand, if governance is effective, there would be optimum risk monitoring despite fluctuations in distress levels. Therefore, this study examines the corporate governance–derivatives relationship under varying levels of financial distress. The results demonstrate that corporate governance does impact a firm's derivatives decisions when we control for leverage; however, some corporate governance mechanisms exhibit higher sensitivity to the various levels of financial distress. A larger percentage of institutional shareholding, increased audit committee meetings, lower CEO total compensation, and larger bonuses to CEOs have a positive association with derivatives decisions, irrespective of financial distress levels. A lower percentage of insider shareholding, a larger CEO base salary, and older CEOs take more active interest in increasing derivatives usage when the firm faces lower financial distress.

Surprisingly, the board of directors' controls do not influence derivatives' decisions in response to varying levels of financial distress. Further, we find that corporate governance appears to substitute debt borrowings and derivative instruments, either for their financing needs or risk management, with a preference for debt financing.

This study contributes to the literature in several ways. First, this is the first study to examine the implications of financial distress for the governance-derivatives relationship under varying levels of financial distress. Several studies examine the relationship between financial distress and corporate governance in developed countries (Fathi & Gueyié 2001; Sarra 2009; Ellul 2015; Masulis & Thomas – Chi 2009; X Brédart 2014). More recently, Li et al. (2021) developed a model for predicting the sensitivities of financial distress with regard to several governance mechanisms in China, while others have scrutinized the relationship in Indonesia (Giarto & Fachrurrozie 2020; Yusra & Bahtera 2021), Spain (Manzaneque et al. 2016); and Eqypt (Shahwan 2015).

The study closest to ours was conducted in Taiwan. Chen et al. (2020) developed a forecasting model that included different distress thresholds and found that the dynamic model was more accurate. They observe that financial measures, except the debt ratio, are higher in financially sound companies than in financially distressed ones. Their comparison is between financially sound and financially distressed companies and traditional and dynamic models. Our study uniquely investigates corporate governance responses to varying levels of financial distress in companies, using quantile analysis.

Second, our study contributes to the field of corporate governance structures in the following ways: a) It suggests that firms should customize their corporate governance structures according to where they fall in the financial distress spectrum; b) If firms face financial distress volatility due to the nature of the industry or product, then governance mechanisms need to be adjusted accordingly; c) The research highlights that different levels of financial distress need to be incorporated in any study that examines corporate governance risk behavior. Third, this study adds to the literature on corporate governance risk management and financial derivatives.

In the next section, a discussion of the relevant literature is provided, followed by the hypothesis development. In the subsequent sections, we outline the research methodology and provide the test results. The paper concludes with a discussion of the results and conclusions of this study.

LITERATURE REVIEW

Several studies examine the impact of financial distress on firm performance. Other studies have investigated models of financial distress predictability and bankruptcy (Geng et al. 2015; Gunathilaka 2014; Altman et al. 2017). Habib et al. (2020) study the factors and causes of financial distress and investigate corporate governance in this context. However, they suggest that there needs to be a more comprehensive analysis using more sophisticated models to understand the financial distress elements. Research on developing economies demonstrates that the implications of firm distress risk factors on book-to-market and size effects are not significant for such economies. Better predictors need to be determined for financial distress risk in future studies (Idrees & Qayyum 2018). Bartram (2000) examines firms employing derivatives for hedging and finds no dissimilarities in risk in countries with either resilient or fragile shareholder rights, but observes a greater decrease in risk in countries where creditors do not have strong rights, prompting him to advocate the proper monitoring of international derivatives markets. Vafeas and Vlittis (2016) investigate the association of board composition and firm pension policies. They observed that a positive association exists between the levels of pension plan funding and the number of outside directors on the board. Additionally, they suggest that outside directors reduce the link between underfunding in pension plans and financial distress, and they conclude that outside directors act responsibly in relation to beneficiaries. Miglania et al. (2015) also investigate corporate governance in a sample of Australian firms and contend that a greater number of blockholders, insider shareholders, and separate audit committees reduce the propensity for financial distress. While Manzaneque et al. (2016) focus on bankruptcy, financial distress, and board ownership in Spanish firms, the authors observe that board size and the possibility of financial distress have a negative relationship and that ownership concentration has no significant influence on financial distress.

Research also indicates that cash-based CEO compensation is inversely proportional to an organization's CSR strategy and directly proportional to equity-based CEO compensation. This holds true in the context of corporate governance, specifically where ownership structures reflect high levels of director ownership complemented by longer director tenure (Karim & Suh 2018).

A study of risk management policies around the world shows that hedging aims to achieve smooth earnings and satisfaction of shareholder expectations. In addition, regulatory reforms decrease the likelihood of hedging, as they aim to induce market stability (Giambona et al. 2018). Research also shows that companies with greater exposure to exchange rate risks have higher hedging premiums (Prieto et al. 2017).

To the best of our knowledge, there are few or no studies on the impacts of corporate governance on risk management through derivatives usage with respect to the varying levels of financial distress. Furthermore, this study uniquely examines a complete and comprehensive range of corporate governance variables taken together in any one model.

BACKGROUND AND HYPOTHESIS DEVELOPMENT

Hedging reduces financial distress costs that would arise with increased external financing and would deter management from engaging in risky projects to achieve increased shareholder equity at the cost of debt holders (Bessembinder 1991; Mayers & Smith 1987). Kaplan and Zingales (1997) suggest that an increase in debt enhances a firm's financial constraints, as it increases its propensity for bankruptcy and financial distress. However, leverage alone may not indicate financial distress because a firm with ample cash may not be constrained. Therefore, debt and liquidity need to be considered together (Pulvino 1998) to determine the extent of financial distress.

VARYING LEVELS OF LEVERAGE

Financial distress is also an important determinant of hedging. Empirical research indicates a positive association between a firm's financial distress and hedging activities. However, Purnanandam (2004, 2008) suggests that firms' hedging varies in accordance with their levels of financial distress. The author shows that leverage directly impacts hedging in firms that face significant losses. Considering that the level of leverage of firms is essential, the author observes that when firms have higher levels of leverage, there is an inverse relationship between financial distress and hedging. Further, a positive relationship is evident when the levels of debt are moderate.

The author examines asset volatility of firms with asset risks that are, to a large extent, fixed and cannot be changed without incurring additional cost. In this situation, the firm has the option to employ derivatives as a cushion against asset volatility risk, rather than incurring costly changes in asset structures. If the derivatives market is without any attrition and there are no disequilibrium forces, then risk-management policies would yield similar results. Therefore, ceteris paribus, higher investment risk could result in lower risk management through derivatives. Petersen and Thiagaranjan (2000) suggest other means of reducing risk, such as taking foreign loans and moving operations to a foreign country to manage risk. Bartram (2000) examines firms employing derivatives for hedging and finds no dissimilarities in risk in countries with either resilient or fragile shareholder rights, but observes a greater decrease in risk in countries where creditors do not have strong rights. He also advocates proper monitoring of international derivatives markets.

In line with the varying impacts evidenced by Purnanandam (2004), we expect that the variation in financial distress, as evidenced by levels of leverage, would also have an impact on governance risk behavior with regard to financial derivatives. Therefore, this study has two main objectives. First, we investigate whether corporate governance impacts the financial derivatives decisions of a firm faced by financial constraints. Second, we examine whether varying levels of financial distress leads to any variation in the risk management behavior of corporate governance in relation to financial derivatives. Therefore, the hypotheses of this study, in null and alternative forms, are:

H_0 Corporate governance does not influence a firm's financial derivative decisions under varying levels of financial distress.

H_1 Corporate governance influences firms' financial derivative decisions under varying levels of financial distress.

WHY FINANCIAL DISTRESS LEVELS WOULD AFFECT CORPORATE GOVERNANCE BEHAVIOUR

A direct relationship exists between leverage and hedging. If a firm increases its leverage for investment and growth purposes, it faces higher financial constraints through the high interest rates of external financing. Therefore, increasing loans would lead to higher interest payments and a lowering of future financial capacity. To offset financial distress, firms would hedge to ensure smoother and more stable cash flows, thereby reducing their reliance on external financing. The board of directors and management would want to reduce cash volatility and losses to ensure the company's growth and robust profits. This would protect the board's reputation and ensure the directors' position on the board.

Management may seek to provide a perception of effective risk management to markets as a signal of their financial expertise and control over risks and losses. Furthermore, managements are required to disclose and quantify their hedging positions in their financial reports in accordance with accounting standards for non-financial firms. Therefore, boards, audit committees, and other governance mechanisms need to protect their reputations by coping with levels of financial distress as proof of their monitoring and control.

Sometimes, management may rather speculate on gains or support their pet projects to secure performance bonuses, promotions, and/or protect reputation. Other managers may opt for selective hedging, that is, sometimes hedge at other times, playing the markets mainly because of their overconfidence in their derivatives strategies. Simultaneously, firms may not hedge at all because management may lack the expertise or confidence to offset their risks with effective derivatives usage. Hull (2005) warns that, to attain effective hedging, firms need to frequently evaluate their hedging positions to ensure that the hedge is maintained in the face of changing market conditions, which management rarely does. Governance must ensure that risk hedging is effective and minimizes risk and distress. Chen et al. (2020) contended that corporate governance elements in their financial distress prediction models improve their findings. Further, the accuracy of the results increases when they incorporate values pertaining to the dynamic figures of firm value. They conclude that financial distress prediction models must contain corporate governance elements.

There are numerous reasons why management and governance bodies use derivatives to offset the risks of financial constraints. If corporate governance mechanisms are effective, they can channelize the firm's derivatives usage decisions for the benefit of the company. However, when corporate governance is weak, we witness the misuse of financial derivatives.

RESEARCH METHODOLOGY

DATA AND SAMPLE

For this study we collect a sample of firms that are listed on the New York Stock Exchange (NYSE) listed firms for the period from 2004-2011. The main objective of this study is to examine the risk behavior of firms when faced with varying levels of financial constraints. Therefore, we choose the period around the financial crisis: before the crisis: 2004-2006, during the crisis: 2007-2009 and after the crisis: 2010-2011, when we expect to observe high variation in firms' financial constraints. Hence, we examine the risk-hedging behavior of non-financial firms during this period.

The data are derived from the Bloomberg, WRDS Corporate Library, Direct Edgar, and WRDS Compustat databases. After eliminating missing data, we obtain a final unbalanced sample consisting of 6900 firm year observations, with a minimum of 174 firms in 2004 and a maximum number of 1606 firms in 2009.

MEASUREMENT OF DERIVATIVES

The volume of derivatives has increased dramatically, and in keeping with growth, the US has issued several accounting standards. The FASB issued SFAS 161 in 2008 to provide more transparency in firms' use of derivatives. SFAS 161 required qualitative disclosures with regard to derivatives and strategies and quantitative disclosures of gains and losses (realized and unrealized) on derivative instruments. The new standard required disclosures related to hedging positions and performance indicating the location and fair value of derivative instruments included in the balance sheet; a report of derivative gains and losses and related hedged items, and where those amounts are reported in the income statement or in the balance sheet. However, SFAS 161 does not specify the form of disclosure of the volume of derivatives, such as notional amounts, and the firm may select these disclosures.

Therefore, as a result of SFAS 133 and SFAS 161, the recognition requirements for derivatives varied throughout the study period. Manchiraju et al. (2014) point out that the near non-availability of data due to the lack of comprehensive disclosures prior to SFAS 161 contributed to a great extent to the mixed results on derivatives in the literature. In addition to the problem of several accounting standards and variation in disclosure requirements for financial derivatives, SFAS 161 did not specify the form of disclosure of the volume of derivatives, such as notional amounts; it was left to the firm to select the manner of these disclosures.

Thus, there has been great variation in the reporting and measuring requirements used for the valuation of derivatives during our period of study, leading to great variation in the recognition, quantification, and disclosure requirements. Hence, no consistent valuation method is employed for the full period of the data. Hence, in the manner of some researchers (Marsden & Prevost 2005; Mian 1996; Nance et al. 1993), we use a dummy variable for the firms that use derivative instruments in the sample firms.

We collect data related to firms applying derivatives instruments through the Direct Edgar software from the SEC 10-K filings10-K filings. We use the following search words: derivatives*, swap*, future, forward, and the option to filter out derivatives, with the asterisk* as a wildcard that enables a larger search for all words with this prefix. This is in the manner employed by Bartram et al. (2011). We take four lines of sentences surrounding the word, before and after, to ensure that the particular word pertains to derivatives usage and is not merely a mention of the word. We then search millions of rows of data search words and manually collect our final sample of derivative users. In Appendix 1, we provide a description of all variables: derivatives as the dependent variable, independent corporate governance variables, and the control variables used in the models.

SIMULTANEOUS EQUATIONS MODEL

A simultaneous association exists between a firm's debt and derivatives decisions (Titman 1992). Firms switch between hedging and external debt financing to fulfill their funding needs; therefore, debt and derivatives firms use both instruments as part of their capital structure decisions. Therefore, research suggests that there is simultaneity in the use of debt and derivatives, and any study on financial derivatives needs to examine both the derivatives and debt effects simultaneously; otherwise, the results would suffer from omitted variable bias and be inaccurate. In the manner proposed by Maddala (1983), we use a simultaneous equations model to examine the simultaneous impacts of debt and derivatives decisions and investigate the impact of corporate governance on the firm's derivatives decisions. The model used is shown below, and we use Keshk's (2003, p.158-161) model for our analysis:

$$y_1 = \gamma_1 y_2^* + \beta_1^{'} X_1 + \varepsilon_1 \quad (1)$$

$$y_2^* = \gamma_2 y_1 + \beta_2^{'} X_2 + \varepsilon_2 \quad (2)$$

where:

y_1 denotes debt, which is the endogenous, continuous variable.

y_2^* denotes derivatives, which is the endogenous, binary variable

X_1 and X_2 represent the independent variables that are exogenous in (1) and (2), respectively.

$\beta_1^{'}$ and $\beta_2^{'}$ are coefficients in equations (1) and (2),

γ_1 and γ_2 are the coefficients of the endogenous variables in equations (1) and (2), respectively,

ε_1 and ε_2 are the error terms in Equations (1) and (2), respectively.

The model employs the control variables suggested by Titman and Wessels (1988) and Opler and Titman (1996): In the simultaneous equations model (1) shown above, where the interaction variables with leverage are used, we conduct simultaneous equations in two stages, as the Keshak (2003) model cannot handle an interaction form with the predicted variable from the other equation, for example, *LEVERAGE^a_1/(BV/MV), LEVERAGE2^c_1/(BV/MV).* To reduce skewness and kurtosis in the continuous variables, we use arsinh transformations for variables with a large number of negative or zero numbers. Sokal and Rohlf (1981: 859) used this function to correct for variance in the error term and contend that this function can alter a high positive value (y) to a log of that number (2y). (Anscombe 1948; Sokal & Rohlf 1981) The inverse hyperbolic sine is the arsinh (y) function and expressed as $\log(y + \sqrt{y^2+1})$.

In the manner of Purnanandam (2004), we use leverage squared (*LEVERAGE2^c*) to capture the effect of high financial distress. Similarly, we include an interaction variable between the leverage ratio and squared leverage with the inverse of the book-to-market ratio: *LEVERAGE^a*_1/$(BV / MV)_{i,t}$ and *LEVERAGE2^c*_1/$(BV / MV)_{i,t}$, where the predicted value of leverage is taken from the first equation. Purnanandam (2004) suggests that firms with a low book value to market value ratio experience higher deadweight losses of distress and find a positive coefficient for the variable (leverage)*(1/BM) ratio and a negative coefficient for (leverage^2)*(1/BM) in relation to derivatives.

Further, we examine the corporate governance-derivatives relationship when we include levels of financial distress and consider extreme levels of financial distress based on the LEVERAGE^2_1/(BV/MV) variable. We divide the sample into two groups: one contains firms that have a lower than median level of financial distress, and the second sample comprises firms that have financial distress equal to or greater than the median LEVERAGE^2_1/(BV/MV). Here, too, we employ a simultaneous equations methodology in each sub-sample.

RESULTS

UNIVARIATE ANALYSIS

Panel A of Table 1 presents the descriptive statistics of the dependent variables derivatives and leverage in the regression models. The mean and median values of the derivatives (DER) were 0.461 and 0.00, respectively, and 0.205 and 0.148, respectively, for LEVERAGE. This indicates that, on average, the sample firms carry a debt of 20.5% as a percentage of firm value.

Panel B of Table 1 provides descriptive statistics for the corporate governance variables. Untransformed descriptive statistics for corporate governance are presented for clarity and comparison purposes. BDMTGS shows that the least number of board meetings held by any firm is 1.0, and the maximum number is 46; BDSIZE has a mean of 8.8; the mean of independent members on their boards (BDINDEP) is 6.4, while board diversity (BDDIVERS) does not appear to be an important criterion for boards with an average of 0.98 female members on most boards, the minimum number being 0 and the maximum, 6. Panel C presents statistics for the control variables.

TABLE 1. Descriptive statistics for derivatives, leverage and corporate governance

Variables	N	Mean	Standard Deviation	Minimum	Maximum
Panel A: Dependent variables					
DER	6900	0.461	0.499	0.000	1.000
LEVERAGE	6900	0.205	0.208	0.000	0.980
Panel B: Corporate Governance variables					
BDMTGS*	6900	8.007	3.699	1.000	46.000
BDSIZE*	6900	8.815	2.129	4.000	17.000
BDINDEP*	6900	6.411	2.156	1.000	16.000
BDDIVERS*	6900	0.981	0.980	0.000	6.000
CEOAGE*	6900	55.263	7.323	30.000	89.000
CEOTENURE*	6900	8.683	7.527	1.000	54.000
ACSIZE*	6900	5.111	2.181	1.000	16.000
ACMTGS*	6900	3.958	4.657	0	36.000
SHINSIDER	6900	0.137	0.191	0.000	0.963
SHINST	6900	0.675	0.468	0.000	1.000
SHBLOCK	6900	0.236	0.164	0.000	0.979
CEOCOMP	6900	14.060	1.181	2.303	18.794
CEOBONUS	6900	5.080	6.374	0.000	18.159
CEOSALARY	6900	13.337	0.753	2.303	16.194
Panel B: Control variables					
TLCF	6900	0.617	0.486	0.000	1.000
LIQUIDITY	6900	0.205	0.875	-4.083	4.210
ROA	6900	1.322	2.333	-6.293	5.581
SIZE	6900	7.041	1.862	-3.912	12.980
VOL	6900	3.803	0.472	2.427	5.640
R&D	6900	0.497	0.500	0.000	1.000
LEVERAGE	6900	0.205	0.208	0.000	0.980

Notes: The variables are described in Appendix 1. * represents untransformed statistics shown for clarity and comparison. Therefore, these represent the number of units for the corporate governance variables.

Table 2 presents the results of the correlation analysis of the dependent and independent variables. Pallant (2005) indicates that the absence of a high correlation does not guarantee a lack of multicollinearity, and suggests additional tests of tolerance and variance inflation factor (VIF). The results of these additional tests support the Pearson's correlation results.

MULTIVARIATE ANALYSIS

There is a problem of endogeneity due to the simultaneity of the capital structure (debt) and derivative decisions. Therefore, in the manner proposed by Maddala (1983), we conduct a simultaneous regression analysis of derivatives and corporate governance with debt (LEVERAGE) and derivatives (DER) as endogenous dependent variables in the two equations. We also employ Keshak's (2003) model to conduct simultaneous equation regressions. Table 3 presents the results for the full sample.

The first-stage equation shows that all controls are significant, in keeping with the literature. In the second stage equation, the control variables are in line with the financial derivatives literature on R&D and LEVERAGE, indicating a significant positive correlation with derivatives, while LIQUIDITY, BV/MV, and SIZE show a significant negative correlation. We find a negative effect of leverage squared with derivatives, which is significant at the 1% level, in line with Purnanandum (2004, 2008). However, neither interaction variable for leverage is significant, while the eight measures of corporate governance have an impact on derivatives.

$$LEVERAGE^{a}_{i,t} = b_0 + b_1 DERUSE^{b}_{i,t} + b_2 R\&D_{i,t} + b_3 ROA_{i,t} + b_4 SIZE_{i,t} + b_5 VOL_{i,t} + \beta_{i,t}$$

TABLE 2. Pearson Correlation Matrix for Derivatives and Corporate Governance Variables

	DER	*BDMTGS*	*BDSIZE*	*BDINDEP*	*BDDIVERS*	*CEOAGE*	*CEOTENURE*	*SHINSIDER*	*SHINST*	*SHBLOCK*	*ACMTGS*	*ACSIZE*	*CEOCOMP*	*CEOBONUS*	*CEOSALARY*
DER	1	.017	.149**	.129**	.091**	.036**	-.004	-.087**	.090**	-.024*	.081**	.043**	.078**	.042**	.111**
BDMTGS	.017	1	.022	.075**	.043**	-.071**	-.124**	-.132**	-.040**	.058**	.085**	.121**	.034**	-.052**	.017
BDSIZE	.149**	.022	1	.746**	.522**	.057**	-.085**	-.136**	.170**	-.120**	.128**	.372**	.336**	-.007	.294**
BDINDEP	.129**	.075**	.746**	1	.497**	.027*	-.087**	-.383**	.168**	-.080**	.139**	.419**	.315**	-.075**	.282**
BDDIVERS	.091**	.043**	.522**	.497**	1	.019	-.093**	-.125**	.101**	-.110**	.106**	.296**	.249**	-.038**	.233**
CEOAGE	.036**	-.071**	.057**	.027*	.019	1	.343**	.055**	.019	-.072**	-.050**	.099**	.110**	-.050**	.103**
CEOTENURE	-.004	-.124**	-.085**	-.087**	-.093**	.343**	1	.108**	-.004	-.059**	-.024*	-.100**	.004	.036**	.019
SHINSIDER	-.087**	-.132**	-.136**	-.383**	-.125**	.055**	.108**	1	-.147**	-.276**	-.063**	-.194**	-.168**	.019	-.133**
SHINST	.090**	-.040**	.170**	.168**	.101**	.019	-.004	-.147**	1	-.113**	.053**	.091**	.107**	.047**	.077**
SHBLOCK	-.024*	.058**	-.120**	-.080**	-.110**	-.072**	-.059**	-.276**	-.113**	1	-.021	-.037**	-.078**	-.068**	-.031*
ACMTGS	.081**	.085**	.128**	.139**	.106**	-.050**	-.024*	-.063**	.053**	-.021	1	.007	.028*	-.049**	.087**
ACSIZE	.043**	.121**	.372**	.419**	.296**	.099**	-.100**	-.194**	.091**	-.037**	.007	1	.340**	-.250**	.196**
CEOCOMP	.078**	.034**	.336**	.315**	.249**	.110**	.004	-.168**	.107**	-.078**	.028*	.340**	1	.069**	.636**
CEOBONUS	.042**	-.052**	-.007	-.075**	-.038**	-.050**	.036**	.019	.047**	-.068**	-.049**	-.250**	.069**	1	.018
CEOSALARY	.111**	.017	.294**	.282**	.233**	.103**	.019	-.133**	.077**	-.031*	.087**	.196**	.636**	.018	1

Notes: ** and *. depict a significant correlation at the 0.01 level (2-tailed) and 0.05 level (2-tailed) respectively. All variables are defined in Appendix 1.

TABLE 3. Simultaneous equations model of derivatives, leverage and corporate governance, full sample

VARIABLE	LEVERAGE		DERIVATIVE	
	Coeff.	t-value	Coeff.	z-value
DER[b]	0.05***	12.40		
	(0.004)			
ROA	-0.03***	-25.55		
	(0.001)			
SIZE	0.05***	34.43		
	(0.001)			
VOL	0.10***	15.34		
	(0.006)			
R&D	-0.10***	-23.29	0.76***	17.84
	(0.004)		(0.043)	
BDMTGS			-0.02***	-4.74
			(0.043)	
BDSIZE			0.12	1.07
			(0.011)	
BDINDEP			-0.04	-0.55
			(0.077)	
BDDIVERS			-0.04	-1.01
			(0.041)	
SHINSIDER			-0.55***	-5.15
			(0.107)	
SHINST			0.13***	3.47
			(0.037)	
SHBLOCK			-0.36***	-3.18
			(0.112)	
CEOAGE			0.13	0.96
			(0.135)	
CEOTENURE			0.013	0.55
			(0.024)	
CEOCOMP			-0.04**	-2.09
			(0.021)	
CEOBONUS			0.02***	6.46
			(0.003)	
CEOSALARY			0.05*	1.86
			(0.028)	
ACSIZE			-0.13**	-2.46
			(0.054)	
ACMTGS			-0.01	-0.43
			(0.016)	
LEVERAGE[a]			9.94***	17.93
			(0.554)	
LEVERAGE2[c]			-7.03***	-6.99
			(1.005)	
SIZE			-0.03*	-1.76
			(0.014)	

VARIABLE	LEVERAGE		DERIVATIVE	
	Coeff.	t-value	Coeff.	z-value
BV/MV			-0.23***	-3.36
			(0.069)	
TLCF			-0.04	-1.26
			(0.034)	
LIQUIDITY			-0.09***	-3.71
			(0.023)	
LEVERAGE[a]_1/(BV/MV)			-0.25*	-0.85
			(0.296)	
LEVERAGE2[c]_1/(BV/MV)			0.50	0.66
			(0.753)	
Constant	-0.43***	-14.94	-1.92***	-3.22
	(0.029)		(0.596)	
Year effects	yes		Yes	
Industry effects	yes		Yes	
Observations	6900		6900	
R^2 / *Pseudo* R^2	0.34		0.15	

Notes: [a,b] denote the predicted values from the other equations. ***, **, * show statistical significance at the 0.01, 0.05 and 0.10 levels respectively of the p-value for the one-tailed test of null hypothesis that the coefficient is zero. Robust standard errors are shown in parentheses, and the t and z values are also provided. See Appendices 1a and 1b for the definitions of the variables.

TABLE 4. Simultaneous equations model of derivatives, leverage and corporate governance with higher level of financial distress

VARIABLE	LEVERAGE		DERIVATIVES	
	Coefficient	t-stat	Coefficient	z-stat
DER[b]	0.04*	1.89		
	(0.020)			
ROA	-0.03***	-18.31		
	(0.001)			
SIZE	0.02***	11.71		
	(0.002)			
VOL	0.14***	20.91		
	(0.007)			
R&D	-0.10***	-19.01	0.01	0.25
	(0.005)		(0.054)	
BDMTGS			-0.02	-0.40
			(0.058)	
BDSIZE			-0.02	-0.12
			(0.150)	
BDINDEP			-0.08	-0.80
			(0.105)	
BDDIVERS			-0.03	-0.46
			(0.056)	
SHINSIDER			-0.09	--0.60
			(0.153)	
SHINST			0.12**	2.51
			(0.049)	

VARIABLE	LEVERAGE		DERIVATIVES	
	Coefficient	t-stat	Coefficient	z-stat
SHBLOCK			-0.09	-0.60
			(0.155)	
CEOAGE			0.04	0.21
			(0.188)	
CEOTENURE			0.002	0.07
			(0.033)	
CEOCOMP			-0.05*	-1.83
			(0.028)	
CEOBONUS			0.01**	2.21
			(0.004)	
CEOSALARY			0.07	1.17
			(0.056)	
ACSIZE			0.04	0.56
			(0.070)	
ACMTGS			0.05**	2.21
			(0.021)	
LEVERAGE[a]			-0.04	-0.10
			(0.368)	
SIZE			0.06***	2.82
			(0.020)	
BV/MV			0.02	0.35
			(0.056)	
TLCF			-0.01	-0.26
			(0.047)	
LIQUIDITY			-0.08**	-2.38
			(0.033)	
Constant	-0.30***	-8.68	-1.61	-0.66
	(0.035)		(0.927)	
Year dummies	Yes		Yes	
Industry dummies	Yes		Yes	
No. of observations	3450		3450	
R^2 / Pseudo R^2	0.36		0.02	

Notes [a,b] denote the predicted values from the other equations. ***, **, * show statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, of the p-value for the one-tailed test of the null hypothesis where the coefficient was zero. Robust standard errors are shown in parentheses, and the t and z values are also provided. See Appendices 1a and 1b for the definitions of variables.

$$
\begin{aligned}
DERUSE^{b}_{i,t} &= c_0 + c_1 BDMTGS_{i,t} + c_2 BDSIZE_{i,t} + c_3 BDINDEP_{i,t} \\
&+ c_4 BDDIVERS_{i,t} + c_5 SHINSIDER_{i,t} + c_6 SHINST_{i,t} \\
&+ c_7 SHBLOCK_{i,t} + c_8 CEOAGE_{i,t} + c_9 CEOTENURE_{i,t} \\
&+ c_{10} CEOCOMP_{i,t} + c_{11} CEOBONUS_{i,t} + c_{12} CEOSALARY_{i,t} \\
&+ c_{13} ACSIZE_{i,t} + c_{14} ACSIZE_{i,t} + c_{15} LEVERAGE^{a}_{i,t} \\
&+ c_{16} LEVERAGE2^{c}_{i,t} + c_{17} SIZE_{i,t} + c_{18} R\&D_{i,t} + \\
&a_{19} \frac{BV}{MV}_{i,t} + c_{20} TLCF_{i,t} + c_{21} LIQUIDITY_{i,t} \\
&+ a_{22} LEVERAGE^{a}\_1/(BV/MV)_{i,t} \\
&+ a_{23} LEVERAGE2^{c}\_1/(BV/MV)_{i,t} + \gamma_{i,t}
\end{aligned}
$$

Table 4 presents the results for firms that exhibit higher levels of financial distress, based on levels equal to or higher than the median of LEV^2_1/(BV/MV), using the specification provided by Purnanandum (2004). The results of the second-stage model with the derivatives as the dependent variable indicate that SHINST, CEOBONUS, and ACMTGS have a statistically significant positive correlation, whereas CEOCOMP has a negative correlation with the derivatives. However, the other corporate governance variables show no significant association with the derivatives, indicating that while board meetings, audit committee size, insider shareholding, blockholders, and CEO base salary impact derivatives decisions when controlling for levels of distress, in the face of extreme financial distress, these corporate governance mechanisms are not significant and may display low confidence or apathy to take any action at all.

$$LEVERAGE^{a}_{i,t} = b_0 + b_1 DERUSE^{b}_{i,t} + b_2 R\&D_{i,t} + b_3 ROA_{i,t} + b_4 SIZE_{i,t} + b_5 VOL_{i,t} + \beta_{i,t}$$

$$DERUSE^{b}_{i,t} = c_0 + c_1 BDMTGS_{i,t} + c_2 BDSIZE_{i,t} + c_3 BDINDEP_{i,t} + c_4 BDDIVERS_{i,t} + c_5 SHINSIDER_{i,t} + c_6 SHINST_{i,t} + c_7 SHBLOCK_{i,t} + c_8 CEOAGE_{i,t} + c_9 CEOTENURE_{i,t} + c_{10} CEOCOMP_{i,t} + c_{11} CEOBONUS_{i,t} + c_{12} CEOSALARY_{i,t} + c_{13} ACSIZE_{i,t} + c_{14} ACMTGS_{i,t} + c_{15} LEVERAGE^{a}_{i,t} + c_{16} SIZE_{i,t} + c_{17} R\&D_{i,t} + c_{18} \frac{BV}{MV}_{i,t} + c_{19} TLCF_{i,t} + c_{20} LIQUIDITY_{i,t} + \gamma_{i,t}$$

Table 5 exhibits firms with lower than median financial distress. The significant findings show that institutional shareholding, audit committee meetings, CEO bonus, CEO base salary and CEO age have a positive correlation, while insider shareholding and CEO total compensation have a negative relationship with the derivatives. The results for board meetings, audit committee size and block holders which were significant in the full sample are now insignificant, indicating that these corporate governance mechanisms are unresponsive at low levels of financial distress.

When we control for the effects of levels of financial distress, we find a significant impact of board meetings, audit committee size, shareholding (insider, institutional, block), and CEO compensation (total, base salary, and bonus). When we introduce extreme levels of financial distress, the effects of institutional shareholding, CEO bonus, and CEO total compensation remain unchanged. Audit committee meetings are significant at extreme levels of distress. Additionally, insider shareholders, CEO base salary, and CEO age influence derivatives decisions when distress is low.

$$LEVERAGE^{a}_{i,t} = b_0 + b_1 DERUSE^{b}_{i,t} + b_2 R\&D_{i,t} + b_3 ROA_{i,t} + b_4 SIZE_{i,t} + b_5 VOL_{i,t} + \beta_{i,t}$$

$$DER^{b}_{i,t} = c_0 + c_1 BDMTGS_{i,t} + c_2 BDSIZE_{i,t} + c_3 BDINDEP_{i,t} + c_4 BDDIVERS_{i,t} + c_5 SHINSIDER_{i,t} + c_6 SHINST_{i,t} + c_7 SHBLOCK_{i,t} + c_8 CEOAGE_{i,t} + c_9 CEOTENURE_{i,t} + c_{10} CEOCOMP_{i,t} + c_{11} CEOBONUS_{i,t} + c_{12} CEOSALARY_{i,t} + c_{13} ACSIZE_{i,t} + c_{14} ACMTGS_{i,t} + c_{15} LEVERAGE^{a}_{i,t} + c_{16} SIZE_{i,t} + c_{17} R\&D_{i,t} + c_{18} \frac{BV}{MV}_{i,t} + c_{19} TLCF_{i,t} + c_{20} LIQUIDITY_{i,t} + \gamma_{i,t}$$

ADDITIONAL TESTS: QUANTILE REGRESSIONS

Purnanandum (2004, 2008) finds no monotonic association between debt and hedging activities within a firm. The author uses spline or piecewise regression analysis, where he divides the data into deciles based on leverage levels: a) the first group comprises 1-5 deciles to capture low leverage; b) this group consists of deciles 6-9 representing firms with temperate to high leverage; and c) the third group consists of 10 deciles with very high leverage. The author found a strong relationship between leverage and derivatives decisions and a U-shaped association between risk management motivations and financial distress when considering deadweight losses.

Table 6 depicts the quantile regression analysis, through which we investigate corporate governance responses at different quantiles of leverage. The results support the main results, and, as expected, derivatives usage has a strong and positive relationship with the amount of debt taken by the firm. The mechanisms of board size and frequency of board meetings denote a strong positive response to the level of debt borrowing of the firm, while board independence has a negative association, indicating that reduced independence of boards causes an increase in debt financing, whereas board diversity does not seem to have any significant impact.

Older CEOs appear to have a significant impact only in the higher quantiles of financial distress, while longer-tenured CEOs appear to be effective at lower levels of financial distress. Audit committee meetings appear to have a minimal impact, and audit committee size has a positive effect at lower levels of financial distress. While insiders and blockholders respond to leverage positively at higher levels of debt, institutional shareholders have a debt reducing impact at higher quantiles. CEO salary appears to have a strong positive impact on leverage throughout the quantiles, while CEO bonus induces a negative impact at higher levels of financial distress.

The controls are significant and aligned with extant literature. The graphs for the regressions at the 10%, 25%, 50%, 75%, 85%, and 95% quantiles of the sample are shown in Appendix 2, and a description of all the variables is provided in Appendix 1.

The graphical depictions indicate a level of monotonic relationship with leverage, with some showing an increasing curve and others showing a downward or decreasing curve. The graphs show skewness in corporate governance factors for firms with lower and higher levels of financial distress.

TABLE 5. Simultaneous equations model of derivatives, leverage and corporate governance with lower level of financial distress

VARIABLE	LEVERAGE		DERIVATIVES	
	Coefficient	t-stat	Coefficient	z-stat
DER[b]	0.05***	7.62		
	(0.006)			
ROA	-0.004***	-5.90		
	(0.001)			
SIZE	0.003*	1.73		
	(0.002)			
VOL	0.01***	2.77		
	(0.004)			
R&D	-0.03***	-8.03	0.30***	5.64
	(0.003)		(0.053)	
BDMTGS			0.003	0.04
			(0.058)	
BDSIZE			0.40	1.51
			(0.264)	
BDINDEP			-0.05	-0.43
			(0.114)	
BDDIVERS			-0.065	-0.66
			(0.020)	
SHINSIDER			-0.55***	-3.70
			(0.148)	
SHINST			0.10*	1.96
			(0.051)	
SHBLOCK			-0.00	-0.00
			(0.157)	
CEOAGE			0.43**	2.37
			(0.183)	
CEOTENURE			0.007	-0.20
			(0.033)	
CEOCOMP			-0.07**	-2.22
			(0.030)	
CEOBONUS			0.01**	2.09
			(0.004)	
CEOSALARY			0.09***	2.63
			(0.035)	
ACSIZE			-0.13	-1.55
			(0.083)	
ACMTGS			0.05**	2.52
			(0.021)	
LEVERAGE[a]			0.96	0.20
			(4.902)	
SIZE			0.14***	5.91
			(0.024)	
BV/MV			0.087	0.54
			(0.160)	

VARIABLE	LEVERAGE		DERIVATIVES	
	Coefficient	t-stat	Coefficient	z-stat
TLCF			-0.04	-0.74
			(0.048)	
LIQUIDITY			-0.09	-1.15
			(0.082)	
Constant	0.03	1.30	-4.12***	-3.84
	(0.022)		(1.072)	
Year effects	yes		yes	
Industry effects	yes		yes	
Observations	3450		3450	
R^2 / Pseudo R^2	0.18		0.08	

Notes: [a,b] denote the predicted values from the other equations. ***, **, * show statistical significance at the 0.01, 0.05 and 0.10 levels respectively of the p-value for the one-tailed test of null hypothesis that the coefficient is zero. Robust standard errors are shown in parentheses, and the t and z values are also provided. See Appendices 1a and 1b for the definitions of variables.

TABLE 6. Quantile regression analysis for leverage

Quantiles	(10%)	(25%)	(50%)	(75%)	(85%)	(95%)
VARIABLES	Model	Model	Model	Model	Model	Model
DER	0.01***	0.03***	0.03***	0.04***	0.04***	0.06***
	(0.001)	(0.003)	(0.004)	(0.006)	(0.007)	(0.013)
BDMTGS	0.00***	0.01***	0.03***	0.03***	0.05***	0.06***
	(0.001)	(0.004)	(0.005)	(0.007)	(0.009)	(0.017)
BDSIZE	0.04***	0.08***	0.10***	0.12***	0.10***	0.12***
	(0.003)	(0.009)	(0.014)	(0.019)	(0.024)	(0.041)
BDINDEP	-0.01**	-0.02***	-0.03***	-0.05***	-0.04**	-0.05*
	(0.002)	(0.006)	(0.010)	(0.013)	(0.017)	(0.029)
BDDIVERS	-0.00**	0.00	0.00	-0.00	-0.01	0.00
	(0.001)	(0.004)	(0.005)	(0.007)	(0.009)	(0.016)
CEOAGE	0.00	0.00	0.01	0.03	0.05*	0.09*
	(0.004)	(0.011)	(0.016)	(0.021)	(0.028)	(0.050)
CEOTENURE	0.00**	0.00	0.00	0.00	-0.00	0.00
	(0.001)	(0.002)	(0.003)	(0.004)	(0.005)	(0.010)
ACMTGS	-0.00	-0.00*	-0.00*	-0.00*	-0.00	-0.01
	(0.000)	(0.001)	(0.002)	(0.003)	(0.003)	(0.006)
ACSIZE	0.01***	0.02***	0.01**	0.01	0.02*	0.01
	(0.002)	(0.004)	(0.007)	(0.009)	(0.012)	(0.020)
SHINSIDER	-0.01*	-0.02**	-0.02	0.06***	0.17***	0.21***
	(0.003)	(0.009)	(0.013)	(0.017)	(0.023)	(0.040)
SHINST	-0.00	-0.00	-0.01**	-0.02***	-0.02***	-0.02
	(0.001)	(0.003)	(0.004)	(0.006)	(0.008)	(0.014)
SHBLOCK	-0.01***	0.01	0.07***	0.16***	0.23***	0.29***
	(0.003)	(0.009)	(0.013)	(0.018)	(0.025)	(0.047)
CEOCOMP	0.00**	0.00	0.00*	0.00	-0.00	-0.00
	(0.001)	(0.002)	(0.002)	(0.003)	(0.004)	(0.009)
CEOSALARY	0.00*	0.01***	0.01***	0.01**	0.01**	0.03*
	(0.001)	(0.002)	(0.003)	(0.005)	(0.006)	(0.015)

Quantiles	(10%)	(25%)	(50%)	(75%)	(85%)	(95%)
VARIABLES	Model	Model	Model	Model	Model	Model
CEOBONUS	-0.00	0.00	-0.00***	-0.00***	-0.00***	-0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
SIZE	0.00***	0.00***	0.00	0.01**	0.01***	0.02***
	(0.000)	(0.001)	(0.002)	(0.002)	(0.003)	(0.005)
TLCF	-0.00	-0.01***	-0.01**	-0.00	-0.01	0.03***
	(0.001)	(0.003)	(0.004)	(0.006)	(0.007)	(0.013)
BV/MV	0.02***	0.09***	0.17***	0.20***	0.18***	0.15***
	(0.001)	(0.003)	(0.004)	(0.004)	(0.005)	(0.011)
LIQUIDITY	-0.01***	-0.04***	-0.06***	-0.07***	-0.07***	-0.07***
	(0.001)	(0.002)	(0.003)	(0.004)	(0.005)	(0.008)
R&D	-0.00	-0.01**	-0.04***	-0.08***	-0.10***	-0.11***
	(0.001)	(0.003)	(0.004)	(0.006)	(0.008)	(0.015)
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.13***	-0.34***	-0.37***	-0.41***	-0.47***	-0.75***
	(0.018)	(0.047)	(0.071)	(0.099)	(0.129)	(0.229)
Observations	6,900	6,900	6,900	6,900	6,900	6,900
Pseudo R^2	0.0230	0.1530	0.2529	0.2863	0.2869	0.2619

DISCUSSION AND CONCLUSION

The results indicate that selective corporate governance mechanisms impact a firm's derivatives decisions and that there is variation in governance risk behavior in response to the level of financial distress. In all situations, CEO bonus, CEO total compensation, and institutional shareholders consistently influence derivatives decision. While audit committees appear to become more active when faced with extreme levels of financial distress. Older CEOs, higher CEO base salaries, and a lower percentage of insider shareholders only respond to lower levels of financial distress, while the effects of board meetings, audit committee size, and blockholders on derivatives are negligible in the face of varying levels of financial distress. A greater response in corporate governance mechanisms during low or controlled financial distress could indicate a lack of confidence or risk aversion when faced with higher levels of financial distress, making the role of financial derivatives hedging more critical.

We derive support from the literature for the strong effect of CEO compensation, where an increase in CEO bonus and base salary enhances the amount of derivatives used, whereas an increase in total compensation reduces the level of derivatives used. Some researchers suggest that stocks reduce volatility, while options increase volatility (Rajgopal & Shevlin 2002; Schrand & Unal 1998). Stronger equity incentives are associated with less risk-taking, whereas portfolio convexity due to options encourages more risk-taking (Coles et al. 2006; Guay 1999; Lewellen 2006; Tufano 1996). Risk tolerance in executives is positively related to incentive pay levels, and there is also a concern that incentive compensation encourages managers to manipulate performance measures (Benmelech et al. 2010; Bolton et al. 2006; Goldman & Slezak 2006), and some attribute it to the options component and some to the stock component of compensation.

With respect to shareholding, the results indicate that insider and block shareholders decrease the amount of derivatives in firms, while institutional shareholders have a positive correlation with derivatives. This is in line with Allayannis et al. (2012), who find that higher outside shareholdings and lower inside ownership increase derivatives hedging within the firm. Therefore, reduced managerial ownership results in increased derivatives and aligns with the objectives of other shareholders.

Through quantile regression analyses, we conclude that there is a substitution effect on how corporate governance uses debt and derivatives. Board meetings, board size, insider and block shareholders, CEO compensation, and audit committee size enhance the utilization of debt financing, with a reduction/no effect on derivative usage. Board independence, institutional shareholders, CEO bonus, and audit committee meetings have a negative impact on debt utilization, with the reverse effect on derivatives usage decisions. CEO base salary has an increasing effect on both debt and derivatives utilization in the firm.

In conclusion, this study examines the risk-monitoring effects of corporate governance through financial derivatives in the face of varying levels of financial distress. The results indicate that corporate governance mechanisms impact a firm's derivatives decisions when financial distress effects are controlled for. However, at high and low levels of distress, there is variation in the corporate governance risk response. Quantile analyses document a substitution effect between debt and derivatives utilization by corporate governance, with a greater propensity for debt utilization. This study employs a simultaneous equations methodology to examine a firm's capital structure and derivatives usage decisions simultaneously, as firms would consider both in their financing decisions.

This is one of the few studies that consider varying levels of financial distress in the examination of the role of corporate governance in derivatives risk management. It makes several contributions to the literature by suggesting that governance structures and mechanisms cope differently with fluctuations in financial distress faced by firms. Further, we observe that corporate governance is more prone to debt borrowings rather than the utilization of derivative instruments that could stem from their financing or risk management needs, or simply a discomfort in delving into derivatives.

The study provides strong evidence that corporate governance has an impact on a firm's derivatives decisions. Second, the results indicate that corporate governance variables are sensitive to changes in firms' levels of financial distress. Thus, we conclude that hedging decisions become more crucial when there is a lack of confidence and aversion to making decisions related to financial derivatives in the face of high financial distress. This suggests that firms in different quantiles of financial distress should adjust their corporate governance mechanisms to achieve optimal derivatives risk management. It also indicates that varying intensities of financial distress need to be incorporated in studies that examine the risk management impacts of corporate governance to obtain realistic results.

LIMITATIONS OF THE STUDY

This study attempts to capture the various financial constraints of non-financial firms through an examination of them during the financial crisis period. However, it only examines the impacts in the US environment. The results may differ in European and developing countries. Therefore, it is suggested that other studies be conducted in different countries to investigate whether corporate governance risk behavior at different levels of financial constraints exhibits the same results.

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APPENDIX 1. Definition of Variables

Variable	Definitions
CEOBONUS	Ln of Cash or cash equivalent of any annual incentive award to the Chief Executive Officer CEO). 1 has been added to the original figure to include any zero values.
CEOSALARY	Ln of CEO salary, which can include non-cash elements and salary taken as deferred compensation.
CEOCOMP	Ln of Sum of base salary, annual bonus and other annual compensation to CEO.
CEOAGE	Ln of the age of the current CEO.
CEOTENURE	Ln Years of service of the current CEO.
BDINDEP	Ln of the sum of all fully independent directors on a given board.
BDSIZE	Ln of the total number of directors on a given board (does not include emeritus or advisory member positions).
BDDIVERS	Ln of the sum of female directors on a given board.
BDMTGS	Ln of number of full board meetings held.
SHINSIDER	Estimated percentage of outstanding shares held by top management and directors.
SHBLOCK	Estimated percentage of outstanding shares held by those whose shareholding is 5% or greater.
SHINST	Indicates whether or not a majority of outstanding shares are held by institutions. Dummy variable taken as 1 if institutional majority, otherwise 0.
ACSIZE	Ln of the number of directors on the audit committee during the year.
DER	Taken as 1 where firms use derivatives and 0, otherwise
	Represents natural logarithm of: Stock Return atility which is the standard deviation of day-to-day logarithmic price changes. A previous day 260-day price atility equals the annualized standard deviation of relative price change of the 260 most recent trading days‘ closing price, expressed as a percentage, for the day prior to the current.
ROA	Represents arsinh or inverse hyperbolic sine) of Return on Assets taken as a percentage and indicates how profitable a company is relative to its total assets. ROA gives an idea as to how efficient management is at using its assets to generate earnings. Calculated as: Trailing 12 Months Net Income / Average Total Assets) * 100.
LEVERAGE	Represents total debt scaled by firm value, where: total debt is the sum of short term debt and long term debt. Firm value is constructed as the sum of market value of equity, total debt (as above), and preferred equity.
SIZE	Ln of sales/revenue/turnover - Total of operating revenues less various adjustments to gross sales
LIQUIDITY	Ln of quick ratio calculated as liquid assets/current liabilities, where: liquid assets = cash and near-cash items + marketable securities and short-term investments + accounts receivable and notes receivable.
TLCF	Tax loss carry forward: taken as a dummy variable of 1 if company has tax loss carry forward, otherwise 0.
R&D	Research and development: taken as 1 where firms indicate expenditure on research and development, otherwise zero
LEVERAGE2[c]	This represents the square of the leverage predicted value, where leverage represents total debt scaled by total market value of assets, where total debt is the sum of short term debt and long term debt. Market value of total assets is constructed as the sum of market value of equity, total debt (as above), and preferred equity.
LEVERAGE[a]	Represents the predicted value of LEVERAGE as defined above.
LEVERAGE[a]_ 1/.BV/MV)	Represents LEVERAGE predicted value multiplied by the inverse of BV/MV
LEVERAGE2[c]_ 1/.BV/MV)	Represents the square of predicted LEVERAGE value multiplied by the inverse of BV/MV.
BV/MV	Taken as book value of equity scaled by market value of equity, and taken as inverse of : .PX_TO_BOOK_RATIO)

Ln = natural logarithm function and as = arc sinh is the inverse hyperbolic sine function.

APPENDIX 2. Quantile regression graphical depiction for financial constraints