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Master thesis

經理人薪酬誘因與負債期限結構：

一般期間與金融危機期間之比較

CEO compensation incentives and corporate's debt maturity structure: normal time versus crisis time

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經理人薪酬誘因與融資決策

CEO Compensation Incentives and Debt Financing

本論文係殷宜汶君（R03724013）在國立臺灣大學國際企業學系暨研究所完成之碩士學位論文，於民國 105 年 6 月 28 日承下列考試委員審查通過及口試及格，特此證明

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兩年的碩士時光轉眼間便流逝，論文是碩士生涯的最後一哩路，也是碩士生活中最重要的環節之一，經過將近一年的努力，從訂定題目方向、閱讀文獻、建立假設、蒐集資料、分析資料……，一直到最後的論文撰寫，這當中遇到許多困難，包括一開始連資料都看不懂的挫折，到後來跑程式遇到各種卡關而停滯，如今能夠順利完成這篇論文，並且得到崇越論文大賞優良論文獎的讚揚，真的要感謝一路上許多人的幫助與支持。

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中文摘要

薪酬制度的設計影響經理人的風險偏好，在控制其他條件不變之下，當 CEO 的薪酬對於公司股價波動度的敏感度(一般用希臘字母 vega 表示)越高，其將有較大誘因去承擔風險。過去已有許多文獻探討薪酬誘因對公司負債期限結構之影響，但未有文獻提出薪酬誘因之影響力在不同總體經濟情況下的差異，本篇論文將 vega 對負債期限結構之影響切分為一般期間及金融危機期間，檢驗在不同期間內 vega 之影響是否有不一樣的表現，藉以補足過去文獻尚未探討之議題。經過實證分析，我們發現整體而言，當 vega 越大時，公司將採取較高風險的負債期限結構，使用較多的短期負債，然而，考慮不同期間的影響之後，我們發現這樣的關係通常只存在於一般期間，而在金融危機期間，vega 對公司負債期限結構的影響將變得不顯著。此外，我們也發現當公司在金融危機前採取較短期的負債期限結構，其在金融危機期間將有相對較差的股價表現。

關鍵字：經理人薪酬、薪酬誘因、風險承擔、融資決策、負債期限結構、金融危機、次貸危機

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ABSTRACT

Literature shows that the sensitivity of CEO compensation to stock return volatility (vega) increases CEO's appetite for risk (after controlling the effect of delta). This paper extends our knowledge of the relationship between vega and firm's riskier debt maturity structure by examining whether the effect of vega on debt maturity in normal time differentiate from which in crisis time. Consistent with prior literature, we find firms with higher vega tend to use larger proportion of short-term debt. After considering the effect of external macro condition, the effect of vega on firm's debt maturity structure is only significant in normal period but not in crisis period. Also, firms with riskier debt maturity policy before the financial crisis performed worse than others during the crisis. Debt maturity structure thus can explain the cross-sectional heterogeneity in the risk-taking behavior among firms.

Key Words: Executive compensation; Incentives; Risk taking; Financing policy; Debt maturity; Financial crisis; Credit crisis

doi:10.6342/NTU201700524

CONTENTS

doi:10.6342/NTU201700524

TABLES

doi:10.6342/NTU201700524

1. Introduction and Motivation

As mentioned in prior literatures (see e.g., Brockman et al., 2010), equity-based compensations such as stocks and options are more and more commonly used to provide incentives to managers that alleviate the principle-agency problem between managers and outside stockholders resulting from the separation of ownership and management. The median of the sensitivity of CEO's compensation to firm's stock performance tripled from 1980 to 1994 and then doubled again from 1994 to 2000 (Hall and Liebman, 1998; Bergstresser and Philippon, 2006). To choose an optimal compensation portfolio which aligns managers' incentives with stockholders' interests, it is important for corporates' owners to understand the effects of managers' compensation incentives on their policy choice behaviors.

A large amount of literatures have tried to explain the relationship between CEO incentives and corporates' policy, and most of them pay attention to two effects of compensations, namely, the sensitivity of CEO's compensation to the stock price (delta) and stock volatility (vega). Many of them have found that the sensitivity of CEO's compensation to stock volatility (after controlling the effect of delta) provides CEO an incentive to take risk, that is, corporates with higher CEO compensation vega tend to choose both risker investment and risker debt policy[1]. However, to our knowledge, there is no prior literature trying to link the effect of managers' compensations and their risky policy choices with the change of external economic environment. During the period of financial crisis when the down-side risk in the macroeconomic becomes larger, is the

[1] See Coles et al. 2006, Chava and Purnanandam, 2010, and Brockman et al. 2010.

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effect of vega on CEO's risk-taking behavior still remain the same? Or, the huge downside risk would reduce the effect of vega on CEO's appetite for risk? Also, dose the riskier policy before the crisis expose firms to more risk making them more fragile during the crisis period?

To discuss the aforementioned questions, we focus on the relationship between corporate's debt maturity structure and CEO's compensation incentives. We examine whether firms with higher CEO vega choose riskier debt maturity policy, that is, use more short-term debt in their debt portfolios. We also examine whether the effect of CEO's compensation vega on their riskier debt maturity choices is smaller during the crisis period than in normal period, and whether riskier debt maturity structure before the crisis would result in a worse performance of the firm during the crisis period.

We collect a sample of 11,323 firm-year observations covering 1,435 different firms during the period from 1992 to 2010 including two of the worst crisis in the US stock market during the past 30 years – dot-com bubble crisis in the years from 2000 to 2001 and subprime mortgage crisis in the years from 2007 to 2009. We define the years between 2001 and 2002 and the years between 2007 and 2009 as crisis period and other years as normal period.

We then apply a pooled cross-sectional, time-series ordinary least squared (OLS) regression with the control of industry and year fixed effect to test our hypotheses. We use the proportion of short-term debt to total debt as our key dependent variable and construct it following the methodology of Huang et al. (2016). Also, we obtain delta and vega from Coles, Daniel, and Naveen (2013), which covers 5,871 CEOs from 3,608 US

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firms during the period 1992-2010. Considering the joint determinant of maturity and leverage (Barclay et al., 2003), we also use a two-stage least squared (2SLS) regression to provide a more robust result. We adopt a t-test based on heteroscedasticity-consistent estimation of the covariance matrix defined by White (1980) in all of our analyses.

We find that, consistent to prior literatures, corporates with higher CEO's compensation vega have a tendency to use shorter debt. Also, as we hypothesized, we find an empirical evidence that the effect of CEO compensation vega on the use of short-term debt is much smaller in the period of crisis time than in normal time. In addition, firms with shorter debt before the financial crisis are more likely to experience greater reduction in their stock performance during the crisis period.

This paper contributes to the literature in three ways. First, it provides a consistent empirical evidence of the positive relationship between CEO compensation vega and the proportion of short-term debt based on a more generalized sample that covers various industries except financial and utilities industry during a big range of years. Second, it complements prior literatures on the effect of compensation incentives on debt maturity structure by establishing a new linkage between CEO compensation incentives and the external economic environment. We find the compensation effect on debt maturity concentrate on period of prosperity. Finally, it complements the literatures on bans' riskier policy and their performances in financial crisis by showing that firms other than banks perform worse than others if they choose a riskier debt maturity structure.

The remainder of this paper is organized as follow. We provide a further discussion of prior literatures and develop our main hypothesis in Section 2. Section 3 describes data

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sources, sample selection and key variables, and also provides the descriptive statistics to our sample. The specification of our regression models and the empirical results are presented in Section 4. Section 5 concludes.

2. Literatures and Hypotheses

Prior literatures claim that there is an agency problem between managers and outside shareholders. (Jenson and Meckling, 1976). One of the agency problem existing is that when managers' compensations are fixed, that is, not changed with the firm's performance, they may choose the suboptimal but less-riskier policy. To reduce agency costs, firms can aligne mangers' interest with shareholders' by using the equity-based compensations such as stocks or options that increase the sensitivities of managers' compensations to both stock price and stock volatility.

An abundant of prior literatures discussing about the relationship between CEO compensation incentives and corporate's policies. Most of them focus on two main effects affecting CEO's incentives -- the sensitivity of CEO's compensation portfolio to stock price (delta) and stock return volatility (vega). Since higher delta means managers are exposed to more risk, it reduces manager's incentive to take risk. That is to say, managers will choose safer investment and debt policy to avoid risk. In contrast, higher vega provides convex payoffs to managers compensations (see eg., Smith and Stulz, 1985; Guay, 1999), and thus managers with higher vega have larger incentive to choose riskier policy.

doi:10.6342/NTU201700524

Many literatures provide empirical evidences that higher CEO compensation vega implies risker debt policy choices. Coles, Daniel, and Naveen (2006) find a positive relationship between vega and CEO's risk-taking. They obtain an empirical result that firms with higher CEO compensation vega tends to invest more in R&D, invest less in PPE, more focus on a few business lines, and use higher leverage. Chava and Purnanandam (2010) also find corporate's risk-taking is significantly related to the compensation incentives of the firm's key managers. They find CEO compensation vega is significantly positive related to the firm's leverage and negative related to the firm's cash holdings. Brockman, Martin, and Unlu (2010) find a significant relationship between CEO compensation incentives and corporate's debt maturity structure. They find firms with higher CEO vega has a larger proportion of shorter debt.

Among these literatures, we find none of them discusses the effect of the change of external economic environment. Our concern is whether the positive relationship between vega and the implementation of riskier debt policy would be reduced during the financial crisis such as the dot-com bubble crisis in the years from 2000 to 2001 and subprime mortgage crisis in the years from 2007 to 2009. First of all, since the probability of getting loss or going bankrupt becomes much higher during the crisis period than in normal period, CEOs should become much more risk-aversion to avoid losing their jobs or reputations. The increasing down-side risk in the external economic environment should discourage CEOs from taking risk. Second, financial crises decrease the liquidity of the market and raise up the yields of bonds (see eg., Ivashina and Scharfstein, 2010; Puri, Rocholl, and Steffen, 2011). Consequently, it may be hard for CEOs to manipulate the structure of debt. That is, even though they have the incentive to take risk, it is hard for them to do that.

doi:10.6342/NTU201700524

To address the aforementioned concern, we focus on the debt maturity structure and try to examine the relationship between CEO compensation incentives and corporate's debt maturity policy. Since shot-term debts expose the firm to both refinancing risk and higher interest risk, it can be seen as a riskier debt policy compare to long-term debts (Chava et al., 2010). Firms with riskier CEO incentives should have shorter debt maturity. However, during the crisis period, the increasing down-side risk and the illiquidity of the bond market should reduce the effect of higher CEO compensation vega on riskier maturity choices. As a result, we propose our first and second hypothesis.

Hypothesis 1. Firms with higher CEO compensation vega have larger proportion of short-term debt in their debt portfolio.

Hypothesis 2. The positive relationship between CEO compensation vega and shorter debt maturity is weaker in crisis period than in normal period.

Also, in examination of a sample of publicly listed US banks in the most recent financial crisis, several literatures finds an evidence that banks funding with more short-term debt performed worse than other banks in the crisis period. Beltratti and Stulz (2012) and Fahlenbrach, Prilmeier, and Stulz (2012) show that banks that performed poorly in crisis years relied more heavily on short-term funding before the crisis. Palumbo and Parker (2009) also shows financial firms that rely on short-term debt for funding long-term assets became vulnerable to financial shocks and experienced sudden withdrawals of short-term funding.

doi:10.6342/NTU201700524

Our second concern is whether firms other than banks with riskier maturity structure before financial crisis also performed worse during the crisis. Firms with greater risk should be more vulnerable to the external shocks. That is, once the economic goes down, firms with shorter debt maturity would experience poorer stock performance. As a result, we propose our third hypothesis.

Hypothesis 3. Firms with risker debt maturity policy before the crisis period will performed worse than others during the crisis.

3. Data and Variables

3.1. Data Sources and Sample Selection

To test our three main hypotheses, we collect CEO compensation data from COMPUSTAT Executive Compensation (ExecuComp) database, firm-specific annual report data from COMPUSTAT Fundamental Annual database, firm-specific marginal tax rate data from COMPUSTAT Marginal Tax Rates database, firm-specific S&P credit rating data from COMPUSTAT Rating database, monthly stock return data from CRSP, and daily government bond yields from the Board of Governors of the Federal Reserve System Website. Also, we obtain the data for CEO compensation incentives (delta and vega) from Coles, Daniel, and Naveen (2013), which covers 5,871 CEOs from 3,608 US firms during the period 1992-2010.

To build our final sample, we consider all NYSE, NASDAQ, AMEX listed firms in the ExecuComp database spanning the years from 1992 to 2010 which covering the period of dot-com bubble crisis from 2000 to 2001 and subprime mortgage crisis from 2007 to

doi:10.6342/NTU201700524

2009. The time period of our sample are limited to the years covered by the incentive data of Coles, Daniel, and Naveen (2013). Consistent with prior literatures[2], we take off firms in utilities sector (with SIC 4900 to 4950) and finance sector (with SIC 6000 to 6999) from our final sample since they are highly regulated and have abnormal debt financing behavior. Among these data, we omit those observations with missing items as well as those with nonsense values (greater than one or smaller than zero in our maturity measures).[3] To make sure our observations are representative enough, we require our sample with both sales and total capitalization larger than 1 million and exclude those firms with fewer than two consecutive years of data. Following Brockman et al. (2010), we winsorize all variables except dummies to 1% and 99% to eliminate the effect of outliers. Our final sample consists of 11,323 firm-year observations representing 1,435 different firms.

3.2. Key Variable Descriptions

3.2.1. Proxies for Debt Maturity Structure

Following Huang, Tan, Faff (2016), we use the proportion of short-term debt maturing within 1 to 5 years (ST1, ST2, ST3, ST4, ST5) as our maturity measures. We get the data of NP (short-term borrowing), DD1, DD2, DD3, DD4, DD5 (long-term debt due in 1 to 5 years), DLTT (long-term debt), DLC (debt in current liabilities) from COMPUSTAT. With these variables, ST1 is calculated as debt maturing in 1 year (NP +

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[2] See Coles (2006) and Chava (2010).

[3] Consistent with Huang (2016), we also obtain similar results if we replace nonsense value with 0 and 1.

doi:10.6342/NTU201700524

DD1) scaled by total debt (DLTT + DLC), and ST2 to ST5 are calculated in the same methodology.

The ratio of short-term debt due in certain years to the total debt is generally used as the maturity measures by prior literatures. While Datta, Raman (2005) use ST3, Barclay and Smith (1995), Chava, Purnanandam (2010), Brockman, Martin, Unlu (2010) use both ST3 and ST5 in their study. Huang, Tan, Faff (2016) argue that most of the prior literatures choose these variables without particular reason that which variable is a better proxy. As a result, consistent to the study of Huang, Tan, Faff (2016), we use all available variables (ST1 to ST5) to capture corporates' maturity structures.

3.2.2. Proxies for CEO Compensation Sensitivities

We define the sensitivity of CEO compensation to the stock price (DETLA) as the change in the value of CEO's compensation portfolio for a one percentage point increase in firm's stock price. The sensitivity of CEO compensation to the stock volatility (VEGA) is the change in the value of CEO's compensation portfolio for a 0.01 change in the annualized standard deviation of stock returns. We obtain DELTA and VEGA from Coles, Daniel, and Naveen (2013), which covers 5,871 CEOs from 3,608 US firms during the period 1992-2010.[4] Following prior literatures, we use the log transformation of delta and vega as our key independent variables (LDELTA, LVEGA).

3.2.3. Proxy for Normal Period and Crisis Period

[4] Details of method and calculations can be found in Core and Guay (2002), Coles, Daniel, and Naveen (2006) and Coles, Daniel, and Naveen (2013).

doi:10.6342/NTU201700524

Dot-com bubble crisis in the years from 2000 to 2001 and subprime crisis in the years from 2007 to 2009 are two of the worst shocks in the US stock market during the past 30 years. As a result, we define the year between 2000 and 2001 and the years between 2007 and 2009 as crisis period, and other years as normal period. To, identify each period, we use the dummy variable (NORMdummy) which equals to 1 if the observation is in the normal period, and 0 if it is in the crisis period.

3.2.4. Proxy for Crisis Performance

We use the firm's stock return during subprime mortgage crisis years (CRISISRET) as our proxy for its performance during the crisis. Following Fahlenbrach et al. (2012) and Ho et al. (2016), we define the crisis returns as the buy-and-hold returns during the period from July 1, 2007 to December 31, 2008.

3.3. Sample Distribution and Summary Statistics

Table 1 shows the sample distribution by industry and by year. In penal A, we find that, consistent to prior literatures, delta increases a lot from 1992 to 2006. (Hall and Liebman, 1998; Bergstresser and Philippon, 2006; Brockman et al., 2010) However, we also find delta declined a lot during the 2007-2008. This shows an influence of the financial crisis on firm's compensation design. In penal B, we find a great variation between industries in their maturity and leverage policies. These evidences show the important of include industry and year fixed effect into our analysis. The number of

doi:10.6342/NTU201700524

observations in each industry ranges from a low of 37 (Agriculture, Forestry and Fishing) to a high of 6485 (Manufacturing).

[Insert Table 1]

Table 2 shows the summary statistics of our variables. The mean of the sensitivity of CEO compensation portfolio value to the stock price is $668,024 which is slightly higher than that reported by Huang et al. (2016), while the mean of the sensitivity of CEO compensation portfolio value to the stock volatility is $130,740 which is slightly lower. As mentioned by Huang et al. (2016), in the crisis period, the sensitivity of CEO compensation portfolio to the stock price is lower and to the stock volatility is higher since stock options granted to CEOs are less in-the-money during that period. Compared to the years covered by Huang et al. (2016), our data included more non-crisis years and thus with higher DETLA and lower VEGA.

The summary statistics of our maturity measures (ST1, ST2, ST3, ST4, and ST5) show the proportion of short-term debt of those firms in our sample. On average, firms are with 19.4%, 29.2%, 39.7%, 49.9%, 60.6% of their debts maturing in 1, 2, 3, 4, and 5 years, which is pretty close to the results reported by Huang et al. (2016). The remained variables in our study also show similar summary statistics to prior literature. (Coles 2006, Chava 2010, Brockman 2010, Huang et al. 2016).

[Insert Table 2]

doi:10.6342/NTU201700524

To make sure there is no multi-collinearity problem in our analyses, we examine the correlation between each of our variables. Table 3 shows the correlation between the variables used in each of our regression models. Since all of the correlations are low enough, we claim that there is no multi-collinearity problem.

[Insert Table 3]

4. Empirical Analysis

4.1. CEO Incentives and Debt Maturity Policy

4.1.1. Pooled Ordinary Least Square (OLS) Regression Model

To examine our first hypothesis that whether firms with higher CEO compensation vega would choose shorter debt maturity, we construct the following pooled cross-sectional, times-series OLS regression with both 2-digit SIC industry fixed effect and year fixed effect:

$$
\begin{aligned}
ST1_{i.t}&(ST2_{i.t}, ST3_{i.t}, ST4_{i.t}, ST5_{i.t}) \\
&= \beta_0 + \beta_1 LVEGA_{i.t} + \beta_2 LDELTA_{i.t} + \beta_3 LSIZE_{i.t} + \beta_4 (LSIZE\text{^}2)_{i.t} \\
&+ \beta_5 STOCKOWN_{i.t} + \beta_6 STDRET_{i.t} + \beta_7 ABNEARN_{i.t} \\
&+ \beta_8 MTB_{i.t} + \beta_9 AZdummy_{i.t} + \beta_{10} RATEdummy_{i.t} + \beta_{11} AMAT_{i,t} \\
&+ \beta_{12} TERMSTR_{i,t} + \beta_{13} LEVERAGE_{i,t} + \beta_{14} SIC2_i + \beta_{15} FYEAR_t + \varepsilon_{i.t}
\end{aligned}
$$

-- Equation (1)

where SIC2 represents the industry dummies based on 2-digit SIC code and FYEAR represents year fixed effects.

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Following Brokman (2010) and Chava (2010), we use firm size (LSIZE), the square of firm size (LSIZE^2), stock ownership (STOCKOWN), standard deviation of stock return (STDRET), abnormal earnings (ABNEARN), market-to-book value (MTB), rated dummy (RATEdummy), financial healthiness (AZdummy), asset maturity (AMAT), term structure (TERMSTR), leverage (LEVERAGE) as the control variables in our regression model. We do not include regulation dummy since highly regulated industries such as financial industry are excluded from our sample. The definition and construction of these variables are shown in Appendix 1.

Table 4 shows the empirical results from the pooled OLS regression of maturity. To address the possibility of omitted variables, all specifications throughout include both year and industry (two-digit SIC) fixed effects. All of the p-values are based on heteroscedasticity-consistent estimation of the covariance matrix defined by White (1980). According to our first hypothesis, we expect a negative relation between the use of short-term debt (ST1 to ST5) and the sensitivity of CEO's compensation portfolio value to the stock prices (LVEGA). In line with our hypothesis, the regression result give an empirical evidence that vega is a positive related to shorter debt maturity by showing that LVEGA's estimated coefficient is positive (equals 0.006, 0.008, 0.009, 0.009, 0.003 for ST1, ST2, ST3, ST4, ST5, respectively) and statistically significant when we use ST1, ST2, ST3, ST4, but insignificant when using ST5. Consistent with prior literatures, our results supports the theory that controlling for delta, higher vega implies riskier debt maturity policies decisions.

[Inset Table 4]

doi:10.6342/NTU201700524

Besides the key variables, our regression results in Table 4 also shows a result for control variables that is consistent to prior literatures. Most of the control variables are statistically significant and with the expected sign based on previous studies (Brockman et al., 2010; Huang et al. 2016). More specifically, LSIZE^2, STOCKOWN, ABNEARN, MTB are positive and statistically significant, while LSIZE, AZdummy, RATEdummy, AMAT, TERMSTR, LEVERAGE are negative and statistically significant. The results of the coefficients estimators on STDRET in the regression is not significant. Overall, our pooled OLS regression results explain between 16.74% and 20.10% of the variation in short-term debt.

The preferential effect of CEO incentives on debt maturity is not only statistically significant but also economically important. For instance, after controlling for firm characteristics, the coefficient on LVEGA of 0.009 in Model 3 shows that one-standard-deviation increase in LVEGA (by 1.686) would raise the proportion of firm's short-term debt maturing in 3 years by 1.5 percent.

4.1.2. Two Stage Least Square (2SLS) Regression Model

Prior literatures argues that maturity and leverage are jointed determinant (Barclay et al., 2003; Brockman et al., 2010). The endogenous problems occurs if we use the ordinary least square regression. Considering the joint determinant of leverage and maturity which may result in the biasness of the coefficient estimators, we use the two-stage least squared (2SLS) regression as a robust test.

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To construct a 2SLS regression analysis, we have to find instrument variables that are exogenous variables related to leverage but is not related to the error term of the regression relating the debt maturity measures. To find such instrument variables, we study prior literatures on leverage (Coles et al., 2006; Chava et al., 2010, Brockman et al. 2010) and use profitability (PROFIT), net PPE to total assets (PPE), R&D expenditure to sales (RD), marginal tax rates (MTAX), cash compensation of CEO (CASHCOM) as our instrument variables. The definition and construction of these variables are shown in Appendix 1.

In the 2SLS model, we treat LEVERAGE as an endogenous variable that we instrument with PROFIT, PPE, RD, MTAX, CASHCOM in the first stage.

Stage 1. Regress LEVERAGE on the instrument and other exogenous variables of the model:

$$
\begin{aligned}
LEVERAGE_{i,t} = {} & \beta_0 + \beta_1 LVEGA_{i.t} + \beta_2 LDELTA_{i.t} + \beta_3 LSIZE_{i.t} + \beta_4 (LSIZE\hat{}2)_{i.t} \\
& + \beta_5 STOCKOWN_{i.t} + \beta_6 STDRET_{i.t} + \beta_7 ABNEARN_{i.t} \\
& + \beta_8 MTB_{i.t} + \beta_9 AZdummy_{i.t} + \beta_{10} RATEdummy_{i.t} + \beta_{11} AMAT_{i,t} \\
& + \beta_{12} TERMSTR_{i,t} + [\, \beta_{13} PROFIT_{i,t} + \beta_{14} PPE_{i,t} + \beta_{15} RD_{i,t} \\
& + \beta_{16} MTAX_{i,t} + \beta_{17} CASHCOM_{i,t} \,] + \beta_{18} SIC2_i + \beta_{19} FYEAR_t + \varepsilon_{i.t}
\end{aligned}
$$

-- Equation (2)

Stage 2. Replace the fitted value of LEVERAGE derived from the first stage with LEVERAGE in the main regression Eq. (1):

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$$ST1_{i.t}(ST2_{i.t}, ST3_{i.t}, ST4_{i.t}, ST5_{i.t})$$

$$= \beta_0 + \beta_1 LVEGA_{i.t} + \beta_2 LDELTA_{i.t} + \beta_3 LSIZE_{i.t} + \beta_4 (LSIZE\hat{}2)_{i.t}$$

$$+ \beta_5 STOCKOWN_{i.t} + \beta_6 STDRET_{i.t} + \beta_7 ABNEARN_{i.t}$$

$$+ \beta_8 MTB_{i.t} + \beta_9 AZdummy_{i.t} + \beta_{10} RATEdummy_{i.t} + \beta_{11} AMAT_{i,t}$$

$$+ \beta_{12} TERMSTR_{i,t} + \beta_{13} LEV\widehat{ERAG}E_{\iota,t} + \beta_{14} SIC2_i + \beta_{15} FYEAR_t + \varepsilon_{i.t}$$

-- Equation (3)

where i and t denote the i^{th} firm for year t, SIC2 represents the industry dummies based on 2-digit SIC code and FYEAR represents year fixed effects. The definition and construction of these variables are shown in Appendix 1.

Table 5 shows the second stage results of the 2SLS regression. Model 1 of Table 5 reports the first stage results relating LEVERAGE to the instrument variables and other exogenous variables in the model of maturity measures. Consistent with prior literatures, the first stage results show that LEVERAGE is positive related to PROFIT, RD, and CASHCOM, and negative related to PPE and MTAX (see e.g., Guay, 1999; Coles et al, 2006; Chava et al. 2010).

Models 2, 3, 4, 5, and 6 report the coefficients from the second stage regression of the maturity measures on the value of $\mathrm{LEV\widehat{ERA}GE}$ and the corresponding exogenous control variables. The result still support the theory between higher vega implies riskier debt maturity policy decisions by showing that the coefficient estimators of LVEGA is positive and statistically significant. Overall, our 2SLS results confirm the regression results of ordinary least squared regression and indicates the positive relationship between vega and riskier debt policy. Our findings are robust to an endogeneity bias.

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[Inset Table 5]

4.2. Effects of CEO Incentives with External Macro Condition

4.2.1. Pooled Ordinary Least Square Regression Model

In order to test our second hypothesis, we construct a nonlinear OLS regression model which includes all of the independent and dependent variables in the earlier regression Eq. (1), and we add NORMdummy and the interaction term NORMdummy and LVEGA into the regression:

$$
\begin{aligned}
&ST1_{i.t}(ST2_{i.t}, ST3_{i.t}, ST4_{i.t}, ST5_{i.t}) \\
&\quad = \beta_0 + \beta_1 LVEGA_{i.t} + \beta_2 (LVEGA_{i.t} * NORMdummy_{i.t}) \\
&\quad + \beta_3 NORMdummy_{i.t} + \beta_4 LDELTA_{i.t} + \beta_5 LSIZE_{i.t} + \beta_6 (LSIZE\char`^2)_{i.t} \\
&\quad + \beta_7 STOCKOWN_{i.t} + \beta_8 STDRET_{i.t} + \beta_9 ABNEARN_{i.t} \\
&\quad + \beta_{10} MTB_{i.t} + \beta_{11} AZdummy_{i.t} + \beta_{12} RATEdummy_{i.t} + \beta_{13} AMAT_{i,t} \\
&\quad + \beta_{14} TERMSTR_{i,t} + \beta_{15} LEVERAGE_{i,t} + \beta_{16} SIC2_i + \beta_{17} FYEAR_t + \varepsilon_{i.t}
\end{aligned}
$$

-- Equation (4)

where i and t denote the ith firm for year t, SIC2 represents the industry dummies based on 2-digit SIC code and FYEAR represents year fixed effects. Our main variables of interest are LEVEGA and the interaction terms LVEGA * NROMdummy. The definition and construction of all variables are shown in Appendix 1.

Our hypothesis is that if credit crisis would reduce the positive relation between vega and riskier debt policy, then the interaction term LEVEGA * NORMdummy should be positive significant while LVEGA becomes less significant or insignificant.

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Table 6 shows the results of the interaction regression model of financial crisis and CEO's incentives on maturity measures. To address the possibility of omitted variables, all specifications throughout include both year and industry (two-digit SIC) fixed effects. All of the p-values are based on heteroscedasticity-consistent estimation of the covariance matrix defined by White (1980). This result support our second hypothesis by showing that, compared to the results in Table 4, LVEGA's estimated coefficients become insignificant and the coefficients of interaction term LVEGA*NORMdummy are positive and statistically significant. That is to say, in normal times (NORMdummy = 1), there LVEGA is significantly positive related to firm's use of short-term debt. However, during the crisis, there is no significant effect of LEVGA on firm's debt maturity policy. Our results provided an evidence that financial crisis would reduce the effect of CEO's risk-taking compensation incentives on their riskier debt maturity policy choices.

[Insert Table 6]

Besides the key variables, our regression results in Table 6 also shows a result that all control variables are still consistent to prior literatures. (For example, Brockman (2010)). More specifically, SIZE^2, STOCKOWN, STDRET, ABNEARN, MTB are positive and statistically significant, while BL, SIZE, RATEdummy are negative and statistically significant. The results of the coefficients estimators on AMAT, TERMSTR and AZdummy in this regression are not significant.

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4.2.2. Two Stage Least Square (2SLS) Regression Model

We also use a 2SLS regression model to address the endogeneity problem. The methodology are described in Section 4.1.2.

Stage 1. Regress LEVERAGE on the instrument and other exogenous variables of the model:

$$
\begin{aligned}
LEVERAGE_{i,t} = {} & \beta_0 + \beta_1 LVEGA_{i.t} + \beta_2 (LVEGA_{i.t} * NORMdummy_{i.t}) \\
& + \beta_3 NORMdummy_{i.t} + \beta_4 LDELTA_{i.t} + \beta_5 LSIZE_{i.t} + \beta_6 (LSIZE\hat{}2)_{i.t} \\
& + \beta_7 STOCKOWN_{i.t} + \beta_8 STDRET_{i.t} + \beta_9 ABNEARN_{i.t} \\
& + \beta_{10} MTB_{i.t} + \beta_{11} AZdummy_{i.t} + \beta_{12} RATEdummy_{i.t} + \beta_{13} AMAT_{i,t} \\
& + \beta_{14} TERMSTR_{i,t} + [\, \beta_{15} PROFIT_{i,t} + \beta_{16} PPE_{i,t} + \beta_{17} RD_{i,t} \\
& + \beta_{18} MTAX_{i,t} + \beta_{19} CASHCOM_{i,t} \,] + \beta_{20} SIC2_i + \beta_{21} FYEAR_t + \varepsilon_{i.t}
\end{aligned}
$$

-- Equation (5)

Stage 2. Replace the fitted value of LEVERAGE derived from the first stage with LEVERAGE in the main regression Eq. (4):

$$
\begin{aligned}
& ST1_{i.t}(ST2_{i.t}, ST3_{i.t}, ST4_{i.t}, ST5_{i.t}) \\
& = \beta_0 + \beta_1 LVEGA_{i.t} + \beta_2 (LVEGA_{i.t} * NORMdummy_{i.t}) \\
& + \beta_3 NORMdummy_{i.t} + \beta_4 LDELTA_{i.t} + \beta_5 LSIZE_{i.t} + \beta_6 (LSIZE\hat{}2)_{i.t} \\
& + \beta_7 STOCKOWN_{i.t} + \beta_8 STDRET_{i.t} + \beta_9 ABNEARN_{i.t} \\
& + \beta_{10} MTB_{i.t} + \beta_{11} AZdummy_{i.t} + \beta_{12} RATEdummy_{i.t} + \beta_{13} AMAT_{i,t} \\
& + \beta_{14} TERMSTR_{i,t} + \beta_{15} LEV\widehat{ERA}GE_{i,t} + \beta_{16} SIC2_i + \beta_{17} FYEAR_t + \varepsilon_{i.t}
\end{aligned}
$$

-- Equation (6)

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where i and t denote the i^th^ firm for year t, SIC2 represents the industry dummies based on 2-digit SIC code and FYEAR represents year fixed effects. The definition and construction of these variables are shown in Appendix 1.

Table 7 shows the second stage results of the 2SLS regression. Model 1 of Table 7 reports the first stage results relating LEVERAGE to the instrument variables and other exogenous variables in the model of maturity measures. Models 2, 3, 4, 5, and 6 report the coefficients from the second stage regression of the maturity measures on the value of $\widehat{\text{LEVERAGE}}$ and the corresponding exogenous control variables. The result still support the hypothesis that the positive relationship between CEO compensation vega and shorter debt maturity is weaker in crisis period than in normal period by showing the positive and statistically significant coefficient estimators of LVEGA*NORMdummy. Overall, our 2SLS results confirm the regression results of ordinary least squared regression, that is, our findings are robust to an endogeneity bias.

[Insert Table 7]

4.3. Debt Maturity Policy and the Crisis Return

To test our third hypothesis, we consider the firms in 2006 of our sample and see whether firms with risker debt maturity policy before the crisis period performed worse than others during the crisis. Table 1 shows that there are 551 different firms at the end of fiscal year 2006 in our sample. However, 6 of them do not exist during the whole

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period from 2006 to 2008. As a result, only the observation of 545 different frims in 2006 are included in this analysis. We use a cross-sectional OLS regression:

$$CRISISRET_{i,t} = \beta_0 + \beta_1 ST1_{i.t}(ST2_{i.t}, ST3_{i.t}, ST4_{i.t}, ST5_{i.t}) + \beta_2 LSIZE_{i.t} + \beta_3 STOCKOWN_{i.t} + \beta_4 MTB_{i.t} + \beta_5 LEVERAGE_{i.t} + \beta_6 RET2006_{i.t} + \beta_7 SIC2_i + \varepsilon_{i.t}$$

-- Equation (7)

where i denotes the i^{th} firm for year 2006, SIC2 represents the industry dummies based on 2-digit SIC code. The definition and construction of these variables are shown in Appendix 1.

Following Ho, Huang, Lin and Yen (2016), our key dependent variable is the buy-and-hold return during the subprime crisis years (CRISISRET) which is proxied as firm's compounded monthly stock return during the period from July 1 2007 to Dec 31 2008. Our key independent variable is the proportion of short-term debt maturing within 1 to 5 years (ST1, ST2, ST3, ST4, and ST5). Our hypothesis is that the use of short-term debt which indicates riskier debt behavior would made the firm performed worse than others during the crisis. Following Beltratti and Stulz (2012) and Fahlenbrach, Prilmeier, and Stulz (2012) we also control SIZE, STOCKOWN, MTB, LEVERAGE, and RET2006 in our regression model for crisis return.

Table 8 shows the regression results of our cross-sectional OLS regression. To address the possibility of omitted variables, all specifications throughout include industry (two-digit SIC) fixed effects. All of the p-values are based on heteroscedasticity-consistent estimation of the covariance matrix defined by White (1980). This result support our second hypothesis by showing that all of the estimated coefficient of short-

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term debt measures except ST5 are negative and most of them are statistically significant. This results give an empirical evidence that firms with risker debt policy before the credit crisis performed worse during the financial crisis.

[Insert Table 8]

Besides the key variables, our regression results in Table8 also shows a result that all control variables are consistent with Beltratti and Stulz (2012) and Fahlenbrach, Prilmeier, and Stulz (2012). More specifically, SIZE and STOCKOWN are positive and statistically significant, while LEVERAGE and RET2006 are negative and statistically significant. The results of the coefficients estimators on MTB in the regression is not significant.

5. Conclusion

In this study, we extend prior literatures on CEO incentives and firm's debt maturity structure by considering the effect of external economic condition. The sensitivity of CEO compensation to the stock return volatility (VEGA) provides CEOs an incentive to take risk, that is, they are likely to use more short-term debt in their debt portfolio. However, during the financial crisis, the effect of VEGA on CEO risk-taking behavior should be reduced because of the huge down side risk and the illiquidity of the bond market.

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Empirically, we obtain the CEO incentives data from Coles, Daniel, and Naveen (2013), which covers 5,871 CEOs from 3,608 US firms during the period 1992-2010, and use the proportion of short term debt maturing in one, two, three, four, and five years to measure firm's maturity structure. We examine our hypotheses with a sample of 11,323 firm-year observations representing 1,435 different publically listed firms in a variety of industries spanning the period from 1992 to 2010, which covers two of the worst crisis in the US stock market, namely, the dot-com bubble crisis and the subprime crisis. We find that firms with higher vega tends to use more short-term debt that due in one, two, three, and four years. However, after considering the effect of external economic condition, we find that the effect of vega on debt maturity policy is significant in normal time but not in crisis time. Also, we find those firms with riskier debt maturity structure before the crisis will experience more reduction in their stock performance during the crisis.

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APPENDIX

APPENDIX 1. Variable Definition and Data Sources

This table shows the definition and construction of the variables used in this paper. All variables are constructed at fiscal year-end.

Variable	Definition	Data Source
ABNEARN	Abnormal earnings of the firm. This variable is proxied by the difference between next year's and this year's earnings per share divided by the fiscal year-end stock price. ABNEARN=(IBADJ of time t+1-IBADJ of time t)/(PRCC_F*CSHPRI)	COMPUSTAT Fundamental Annual
AMAT	Asset maturity of the firm. This variable is proxy as the book value-weighted average of the maturities of long-term assets and current assets. The maturity of long-term assets is proxied as gross PPE divided by depreciation expense. The maturity of short-term assets is proxied as current assets divided by costs of goods sold. AMAT=(ACT/COGS)*(ACT/AT)+(PPEGT/DP)*(PPEGT/AT)	COMPUSTAT Fundamental Annual
AZ	Current financial health of the firm. The variable is proxied as a modified version of Altman-z score (Altman, 1977) proposed by MacKie-Mason (1990). AZ=[3.3*OIADP+SALE+1.4*RE+1.2*(ACT-LCT)] /AT	COMPUSTAT Fundamental Annual
AZdummy	Dummy variable equals 1 if AZ is smaller than its first quantile, 2 if AZ is between its first and second quantile, 3 if AZ is between its second and third quantile, and 4 if AZ is larger than its third quantile.	COMPUSTAT Fundamental Annual
CASHCOM	Cash compensation of the firm's CEO in 100 thousands. CASHCOM= TOTAL_CURR	ExecuComp
CRISISRET	Buy-and-hold return during the subprime crisis years. This variable is proxied as firm's compounded monthly stock return during the period from July 1 2007 to Dec 31 2008.	CRSP
DELTA	Dollar change in the value of CEO's compensation portfolio associated with a 1% change in the firm's stock price (in $000s). We obtain this variable from Coles, Daniel, and Naveen (2013), and the details of method and calculations can be found in Core and Guay (2002), Coles, Daniel, and Naveen (2006) and Coles, Daniel, and Naveen (2013).	Coles, Daniel, and Naveen (2013)
LDELTA	Log transformation of DELTA. DELTA is the dollar change in the value of CEO's compensation portfolio associated with a 1% change in the firm's stock price (in $000s). We obtain DELTA from Coles, Daniel, and Naveen (2013), and the details of method and calculations can be found in Core and Guay (2002), Coles, Daniel, and Naveen (2006) and Coles, Daniel, and Naveen (2013). LDELTA=log(1+DELTA)	Coles, Daniel, and Naveen (2013)

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Variable	Definition	Data Source
LEVERAGE	Market leverage of the firm. This variable is proxied as total debt divided by the market value of the firm. TD/(PRCC_F*CSHPRI+AT-CEQ)	COMPUSTAT Fundamental Annual
MTAX	Marginal tax rate of the firm. MTAX = BCG_MTRNOINT	COMPUSTAT Marginal Tax Rates
MTB	The growth opportunities of the firm. This variable is proxied as the market value of the firm divided by the book value of total assets. MTB=(PRCC_F*CSHPRI+AT-CEQ)/AT	COMPUSTAT Fundamental Annual
NORMdummy	Dummy variable equals 1 if fiscal year of the observation is in the normal period, and 0 if it is in the crisis period. We define the years between 2000 and 2001 and the years between 2007 and 2009 as crisis period, and other years as normal period.	COMPUSTAT Fundamental Annual
PPE	Collateral availability of the firm. This variable is proxied as net PPE divided by total assets. PPE=PPENT/AT	COMPUSTAT Fundamental Annual
PROFIT	Profitability of the firm. This variable if proxied as the ratio of net income to total assets. PROFIT=NI/AT	COMPUSTAT Fundamental Annual
RATEdummy	Dummy variable that equals 1 if a firm has an S&P rating on long-term debt (SPLTICRM), and 0 otherwise.	COMPUSTAT Rating
RD	Research and development expenditures scaled by sales. RD=XRD/SALE, zero if missing	COMPUSTAT Fundamental Annual
RET2006	Buy-and-hold return during the calendar year 2006. This variable is proxied as firm's compounded monthly stock return during the period from Jan 1 2006 to Dec 31 2006.	CRSP
SIZE	The size of the firm. This variable is proxied as the market value of the firm. SIZE=(PRCC_F*CSHPRI+AT-CEQ)	COMPUSTAT Fundamental Annual
LSIZE	The size of the firm, in logs. LSIZE=log(SIZE)	COMPUSTAT Fundamental Annual
ST1	Proportion of short-term debt maturing within 1 year. This variable is proxed as the sum of short-term borrowing and long-term debt due in 1 year scaled by the total debt. ST1=(NP+DD1)/(DLTT+DLC)	COMPUSTAT Fundamental Annual
ST2	Proportion of short-term debt maturing within 2 years. This variable is proxed as the sum of short-term borrowing and long-term debt due in 2 years scaled by the total debt. ST2=(NP+DD1+DD2)/(DLTT+DLC)	COMPUSTAT Fundamental Annual

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Variable	Definition	Data Source
ST3	The proportion of short-term debt maturing within 3 years. This variable is proxed as the sum of short-term borrowing (NP) and long-term debt due in 3 year scaled by the total debt. ST3=(NP+DD1+DD2+DD3)/(DLTT+DLC)	COMPUSTAT Fundamental Annual
ST4	The proportion of short-term debt maturing within 4 years. This variable is proxed as the sum of short-term borrowing (NP) and long-term debt due in 4 year scaled by the total debt. ST4=(NP+DD1+DD2+DD3+DD4)/(DLTT+DLC)	COMPUSTAT Fundamental Annual
ST5	The proportion of short-term debt maturing within 1 years. This variable is proxed as the sum of short-term borrowing (NP) and long-term debt due in 5 year scaled by the total debt. ST5=(NP+DD1+DD2+DD3+DD4+DD5)/(DLTT+DLC)	COMPUSTAT Fundamental Annual
STDRET	Monthly stock return standard deviation during the fiscal year multiplied by the ratio of the market value of equity (Item #199 ∗ Item #54) to the market value of assets (Item #199 ∗ Item #54 + Item #6 – Item #60). STDRET=(Stock return standard deviation)*[(PRCC_F*CSHPRI)/(PRCC_F*CSHPRI+AT-CEQ)]	CRSP, COMPUSTAT Fundamental Annual
STOCKOWN	Proportion of outstanding shares own by the firm's CEO. STOCKOWN =SHROWN_EXCL_OPTS_PCT/100, zero if missing	COMPUSTAT Fundamental Annual
TERMSTR	Yield spread of 10-year government bond and 6-month government bond at the end of the fiscal year.	Board of Governors of the Federal Reserve System website
VEGA	Dollar change in the value of CEO’s compensation portfolio associated with a 0.01 change in in the annualized standard deviation of stock returns (in $000s). We obtain this variable from Coles, Daniel, and Naveen (2013), and the details of method and calculations can be found in Core and Guay (2002), Coles, Daniel, and Naveen (2006) and Coles, Daniel, and Naveen (2013).	Coles, Daniel, and Naveen (2013)
LVEGA	Log transformation of VEGA.VEGA is the dollar change in the value of CEO’s compensation portfolio associated with a 0.01 change in the annualized standard deviation of stock returns (in $000s). We obtain VEGA from Coles, Daniel, and Naveen (2013), and the details of method and calculations can be found in Core and Guay (2002), Coles, Daniel, and Naveen (2006) and Coles, Daniel, and Naveen (2013). LVEGA=log(1+VEGA)	Coles, Daniel, and Naveen (2013)

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TABLE 1. Sample Distributions

This table shows the sample distribution by years (Panel A) and by industries (Panel B), and also shows the medians of our key variables for each group. Our sample consists of 11,323 observations representing 1,435 different firms during the time-period from 1992 to 2010. All variables are defined in Appendix 1 and are calculated at the fiscal year end. This result is calculated after winsoring.

Panel A. Medians by Years

Year	N	DELTA	VEGA	LEVERAGE	ST1	ST2	ST3	ST4	ST5
1992	141	156.9763	27.1856	0.1295	0.1711	0.2707	0.3458	0.4304	0.4933
1993	423	129.4434	21.6287	0.1350	0.1257	0.2263	0.3328	0.4462	0.5316
1994	560	120.9751	18.6229	0.1452	0.1176	0.2240	0.3563	0.4563	0.5635
1995	606	146.3902	23.4670	0.1364	0.1266	0.2245	0.3236	0.4317	0.5752
1996	625	172.6916	28.1963	0.1277	0.1119	0.1964	0.3027	0.4299	0.5823
1997	600	227.4869	30.7312	0.1252	0.0990	0.1872	0.3085	0.4230	0.6051
1998	585	221.4238	42.1692	0.1514	0.1061	0.1877	0.3088	0.4553	0.5973
1999	578	236.3938	48.7821	0.1609	0.0943	0.1920	0.3453	0.4908	0.6160
2000	589	228.3746	53.9421	0.1542	0.0959	0.2743	0.4177	0.5386	0.6798
2001	587	271.9318	75.7529	0.1509	0.0767	0.1870	0.3125	0.4770	0.6252
2002	635	226.9625	78.3419	0.1616	0.0645	0.1722	0.3292	0.4708	0.6121
2003	668	295.1521	96.4584	0.1415	0.0673	0.1866	0.3248	0.4565	0.5879
2004	673	335.0328	89.1579	0.1227	0.0647	0.1737	0.3106	0.4461	0.5942
2005	668	319.6094	83.3359	0.1148	0.0725	0.1690	0.2894	0.4164	0.6084
2006	551	330.9092	76.1525	0.1213	0.0622	0.1618	0.2585	0.4005	0.5610
2007	753	267.1534	67.0318	0.1336	0.0669	0.1598	0.2693	0.4073	0.6051
2008	736	142.6964	60.8124	0.1845	0.0599	0.1508	0.3301	0.5062	0.6769
2009	689	197.2282	76.7440	0.1551	0.0564	0.1750	0.3414	0.5394	0.6837
2010	656	252.1773	80.6569	0.1382	0.0537	0.1750	0.3013	0.4331	0.5856

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TABLE 1. Sample Distributions (Continued)

This table shows the sample distribution by years (Panel A) and industries (Panel B), and also shows the medians of our key variables for each group. Our sample consists of 11,323 observations representing 1,435 different firms during the time-period from 1992 to 2010. All variables are defined in Appendix 1. and are calculated at the fiscal year end. This result is calculated after winsoring.

Panel B. Medians by Industry										
Industry	SIC Code	N	DELTA	VEGA	LEVERAGE	ST1	ST2	ST3	ST4	ST5
Agriculture, Forestry and Fishing	0100-0999	37	338.4912	67.491	0.1604	0.2181	0.3023	0.3993	0.5135	0.6411
Mining	1000-1499	705	769.6313	117.4531	0.2023	0.0755	0.1537	0.2561	0.3693	0.484
Construction	1500-1799	74	220.1313	39.8842	0.1023	0.2458	0.3361	0.4423	0.5653	0.7227
Manufacturing	2000-3999	6485	680.5041	130.5064	0.1550	0.2098	0.3086	0.4121	0.5126	0.6167
Transportation	4000-4900	814	1293.5736	187.6194	0.2432	0.1355	0.2145	0.306	0.3929	0.4901
Wholesale Trade	5000-5199	449	534.5933	98.7573	0.1724	0.1848	0.2935	0.4056	0.5154	0.6315
Retail Trade	5200-5999	1196	894.8661	138.5265	0.1682	0.1923	0.291	0.3992	0.493	0.6028
Services	7000-8999	1563	2497.339	184.5969	0.1544	0.2098	0.3259	0.4408	0.5493	0.663

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TABLE 2. Summary Statistics

This table shows the summary statistics of our key numeric variables, including dependent, independent, and control variables. Our sample consists of 11,323 observations representing 1,435 different firms during the time-period from 1992 to 2010. All variables are defined in Appendix 1. and are calculated at the fiscal year end. This result is calculated after winsoring.

	Min.	10%	25%	50%	75%	90%	Max.	Mean	S.D.
DELTA	3.566	35.954	87.539	223.063	579.365	1461.352	11201.204	668.024	1484.750
VEGA	0.000	3.399	16.454	51.611	145.540	342.007	1237.879	130.740	210.971
LDELTA	1.519	3.610	4.483	5.412	6.364	7.288	9.324	5.424	1.463
LVEGA	0.000	1.481	2.860	3.963	4.987	5.838	7.122	3.803	1.686
ST1	0.000	0.000	0.014	0.082	0.249	0.581	1.000	0.194	0.266
ST2	0.000	0.004	0.050	0.188	0.418	0.868	1.000	0.292	0.304
ST3	0.000	0.018	0.126	0.320	0.617	0.996	1.000	0.397	0.326
ST4	0.000	0.050	0.229	0.456	0.791	1.000	1.000	0.499	0.329
ST5	0.000	0.152	0.366	0.605	0.944	1.000	1.000	0.606	0.316
LEVERAGE	0.000	0.017	0.067	0.140	0.237	0.347	0.580	0.166	0.130
STOCKOWN	0.000	0.000	0.000	0.001	0.012	0.055	0.309	0.020	0.051
SIZE	128.755	456.743	974.506	2572.514	8185.848	25780.118	163342.558	10625.532	23983.144
LSIZE	4.858	6.124	6.882	7.853	9.010	10.157	12.004	8.007	1.539
MTB	0.782	1.047	1.240	1.568	2.153	3.080	6.959	1.891	1.052
PROFIT	-0.376	-0.031	0.021	0.053	0.085	0.122	0.237	0.044	0.085
PPE	0.025	0.076	0.146	0.262	0.449	0.654	0.889	0.318	0.218
RD	0.000	0.000	0.000	0.002	0.034	0.114	0.428	0.035	0.070
CASHCOM	152.035	424.014	618.817	945.000	1475.865	2350.000	5842.067	1225.911	979.943
MTAX	0.058	0.294	0.333	0.343	0.350	0.350	0.353	0.327	0.052
STDRET	0.016	0.029	0.040	0.058	0.085	0.123	0.253	0.069	0.043
ABNEARN	-0.422	-0.060	-0.012	0.007	0.025	0.075	0.881	0.016	0.137
AMAT	0.513	1.802	3.645	7.070	13.236	21.444	38.937	9.638	8.192
TERMSTR	-0.580	-0.050	0.410	1.330	2.600	3.250	3.650	1.502	1.293
AZ	-1.804	0.765	1.359	2.034	2.696	3.371	5.079	2.033	1.117

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TABLE 3. Correlation between Variables

This table shows the summary statistics of our key numeric variables, including dependent, independent, and control variables. Our sample consists of 11,323 observations representing 1,435 different firms during the time-period from 1992 to 2010. All variables are defined in Appendix 1 and are calculated at the fiscal year end. This result is calculated after winsoring.

	ST3	LDELTA	LVEGA	SIZE	STOCKOWN	STDRET	ABNEARN	MTB	AZdummy	RATEdummy	AMAT	TERMSTR	NORMdummy	LEVERAGE	PROFIT	PPE	RD	MTAX	CASHCOM
ST3	1.00																		
LDELTA	-0.05	1.00																	
LVEGA	-0.08	0.49	1.00																
SIZE	-0.17	0.56	0.57	1.00															
STOCKOWN	0.08	0.38	-0.25	-0.20	1.00														
STDRET	0.21	0.04	-0.11	-0.28	0.11	1.00													
ABNEARN	0.03	-0.13	-0.08	-0.07	0.01	0.01	1.00												
MTB	0.15	0.38	0.09	0.20	0.06	0.34	-0.05	1.00											
AZdummy	0.13	0.08	-0.06	-0.05	0.08	-0.03	-0.15	0.18	1.00										
RATEdummy	-0.33	0.21	0.34	0.59	-0.18	-0.34	-0.01	-0.10	-0.14	1.00									
AMAT	-0.14	-0.09	-0.05	0.09	-0.06	-0.18	0.02	-0.14	-0.14	0.15	1.00								
TERMSTR	0.02	-0.04	0.06	0.03	-0.03	0.04	0.11	-0.10	-0.04	0.01	0.02	1.00							
NORMdummy	-0.02	0.02	-0.06	-0.05	0.04	-0.15	-0.01	0.07	0.05	-0.01	0.04	-0.15	1.00						
LEVERAGE	-0.29	-0.24	-0.06	-0.04	-0.04	-0.37	0.13	-0.49	-0.38	0.29	0.18	0.03	-0.08	1.00					
PROFIT	0.03	0.29	0.11	0.20	0.04	-0.05	-0.47	0.36	0.49	-0.02	0.00	-0.10	0.06	-0.36	1.00				
PPE	-0.16	-0.05	-0.10	0.07	0.01	-0.17	0.01	-0.15	-0.12	0.15	0.82	-0.02	0.07	0.23	0.01	1.00			
RD	0.10	0.06	0.11	-0.01	-0.05	0.38	0.03	0.27	-0.28	-0.14	-0.20	0.00	-0.01	-0.21	-0.24	-0.30	1.00		
MTAX	-0.08	0.20	0.10	0.22	0.02	-0.28	-0.28	0.02	0.45	0.13	0.03	-0.18	0.05	-0.05	0.54	0.11	-0.38	1.00	
CASHCOM	-0.08	0.41	0.43	0.58	-0.11	-0.19	-0.04	0.09	0.03	0.35	0.02	-0.02	0.07	-0.04	0.15	0.01	-0.07	0.14	1.00

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TABLE 4. Regressions of Maturity Measures on CEO Compensation Incentives (OLS method)

This table shows the pooled ordinary least square (OLS) regression results for 5 specifications. Our sample consists of 11,323 observations representing 1,435 different firms during the time-period from 1992 to 2010. The dependent variables are the proportion of short-term debt maturing within 1 (ST1), 2 (ST2), 3 (ST3), 4 (ST4), and 5 (ST5) years, respectively. The intercepts are not reported. All variables are defined in Appendix 1 and are calculated at the fiscal year end. The p-values are based on heteroscedasticity-consistent estimation of the covariance matrix of the coefficient estimates defined by White (1980). All specifications include both industry (two-digit SIC) and year fixed effects. ***, **, and * indicates significance at the 1%, 5%, and 10% levels, respectively.

Independent Variables	Predicted Sign	(1) ST1			(2) ST2			(3) ST3			(4) ST4			(5) ST5		
		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value	
LVEGA	+	0.006	0.003	***	0.008	0.001	***	0.009	0.000	***	0.009	0.001	***	0.003	0.242	
LDELTA	−	-0.025	0.000	***	-0.028	0.000	***	-0.027	0.000	***	-0.021	0.000	***	-0.005	0.178	
LSIZE	−	-0.099	0.000	***	-0.143	0.000	***	-0.167	0.000	***	-0.137	0.000	***	-0.097	0.000	***
LSIZE^2	+	0.007	0.000	***	0.009	0.000	***	0.010	0.000	***	0.008	0.000	***	0.005	0.000	***
STOCKOWN	+	0.378	0.000	***	0.496	0.000	***	0.429	0.000	***	0.268	0.003	***	-0.052	0.555	
STDRET	+	0.030	0.746		0.120	0.238		0.149	0.156		0.169	0.101	.	0.133	0.168	
ABNEARN	+	0.085	0.000	***	0.077	0.000	***	0.082	0.000	***	0.080	0.000	***	0.086	0.000	***
MTB	+	0.014	0.000	***	0.017	0.000	***	0.013	0.001	***	0.008	0.047	**	0.006	0.112	.
AZdummy	+	-0.001	0.877		0.004	0.430		0.007	0.151		0.010	0.047	**	0.008	0.111	.
RATEdummy	−	-0.070	0.000	***	-0.109	0.000	***	-0.141	0.000	***	-0.162	0.000	***	-0.174	0.000	***
AMAT	−	-0.001	0.042	**	0.000	0.283		0.000	0.306		-0.001	0.078	*	-0.001	0.004	***
TERMSTR	−	-0.009	0.253		-0.014	0.114	.	-0.024	0.010	***	-0.026	0.005	***	-0.017	0.049	**
LEVERAGE	−	-0.514	0.000	***	-0.563	0.000	***	-0.537	0.000	***	-0.439	0.000	***	-0.281	0.000	***
Year fixed effect		Yes			Yes			Yes			Yes			Yes		
Industry fixed effect		Yes			Yes			Yes			Yes			Yes		
Observations		11323			11323			11323			11323			11323		
Adjusted R^2		0.1674			0.1917			0.2010			0.1944			0.1884		

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TABLE 5. Regressions of Maturity Measures on CEO Compensation Incentives (2SLS method)

This table shows the tow stage least square (2SLS) regression results for 5 specifications. Our sample consists of 11,323 observations representing 1,435 different firms during the time-period from 1992 to 2010. The dependent variables are leverage and the proportion of short-term debt maturing within 1 (ST1), 2 (ST2), 3 (ST3), 4 (ST4), and 5 (ST5) years, respectively. The intercepts are not reported. All variables are defined in Appendix 1 and are calculated at the fiscal year end. The p-values are based on heteroscedasticity-consistent estimation of the covariance matrix of the coefficient estimates defined by White (1980). All specifications include both industry (two-digit SIC) and year fixed effects. ***, **, and * indicates significance at the 1%, 5%, and 10% levels, respectively.

Independent Variables	Predicted Sign	(1) LEVERAGE			(2) ST1			(3) ST2			(4) ST3			(5) ST4			(6) ST5		
		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value	
LVEGA	+	-0.001	0.495		0.006	0.005	***	0.008	0.001	***	0.010	0.000	***	0.009	0.000	***	0.004	0.138	.
LDELTA	−	-0.010	0.000	***	-0.027	0.000	***	-0.027	0.000	***	-0.023	0.000	***	-0.016	0.000	***	0.003	0.528	
LSIZE	−	0.033	0.000	***	-0.089	0.000	***	-0.147	0.000	***	-0.183	0.000	***	-0.158	0.000	***	-0.126	0.000	***
LSIZE^2	+	-0.003	0.000	***	0.006	0.000	***	0.010	0.000	***	0.012	0.000	***	0.010	0.000	***	0.007	0.000	***
STOCKOWN	+	-0.055	0.000	***	0.428	0.000	***	0.474	0.000	***	0.347	0.001	***	0.160	0.111	.	-0.204	0.035	**
STDRET	+	0.056	0.000	***	-0.186	0.356		0.218	0.324		0.508	0.025	**	0.638	0.004	***	0.798	0.000	***
ABNEARN	+	0.192	0.000	***	0.096	0.000	***	0.072	0.003	***	0.064	0.009	***	0.056	0.021	**	0.052	0.023	**
MTB	+	-0.855	0.000	***	0.008	0.182		0.019	0.005	***	0.023	0.001	***	0.021	0.002	***	0.024	0.000	***
AZdummy	+	0.007	0.511		-0.014	0.258		0.010	0.458		0.029	0.032	**	0.038	0.004	***	0.047	0.000	***
RATEdummy	−	-0.017	0.000	***	-0.056	0.000	***	-0.116	0.000	***	-0.165	0.000	***	-0.192	0.000	***	-0.217	0.000	***
AMAT	−	-0.001	0.000	***	-0.001	0.021	**	0.000	0.376		0.000	0.616		-0.001	0.277		-0.001	0.053	*
TERMSTR	−	0.003	0.248		-0.008	0.313		-0.014	0.112	.	-0.025	0.007	***	-0.027	0.003	***	-0.020	0.025	**
$\widehat{LEVERAGE}$	−				-0.750	0.000	***	-0.456	0.035	**	-0.145	0.514		0.074	0.736		0.447	0.035	**
PROFIT		-0.218	0.000	***															
PPE		0.043	0.000	***															
RD		-0.145	0.000	***															
MTAX		0.196	0.000	***															
CASHCOM		0.000	0.105	.															
Year fixed effect		Yes			Yes			Yes			Yes			Yes			Yes		
Industry fixed effect		Yes			Yes			Yes			Yes			Yes			Yes		
Observations		11323			11323			11323			11323			11323			11323		
Adjusted R^2		0.5547			0.1404			0.1658			0.1801			0.1807			0.1827		

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TABLE 6. Regressions of Maturity Measures on CEO Compensation Incentives: The Effect of External Economic Condition (OLS method)

This table shows the pooled ordinary least square (OLS) regression results for 5 specifications. Our sample consists of 11,323 observations representing 1,435 different firms during the time-period from 1992 to 2010. The dependent variables are the proportion of short-term debt maturing within 1 (ST1), 2 (ST2), 3 (ST3), 4 (ST4), and 5 (ST5) years, respectively. The intercepts are not reported. All variables are defined in Appendix 1 and are calculated at the fiscal year end. The p-values are based on heteroscedasticity-consistent estimation of the covariance matrix of the coefficient estimates defined by White (1980). All specifications include both industry (two-digit SIC) and year fixed effects. ***, **, and * indicates significance at the 1%, 5%, and 10% levels, respectively.

Independent Variables	Predicted Sign	(1) ST1			(2) ST2			(3) ST3			(4) ST4			(5) ST5		
		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value	
LVEGA	+	0.002	0.486		0.003	0.353		0.000	0.899		-0.001	0.832		-0.004	0.224	
LVEGA*NORMdummy	+	0.007	0.018	**	0.009	0.012	**	0.014	0.000	***	0.015	0.000	***	0.011	0.001	***
NORMdummy	+/−	0.064	0.013	**	0.026	0.351		-0.053	0.065	*	-0.096	0.001	***	-0.091	0.001	***
LDELTA	−	-0.022	0.000	***	-0.025	0.000	***	-0.024	0.000	***	-0.019	0.000	***	-0.003	0.384	
LSIZE	−	-0.083	0.000	***	-0.124	0.000	***	-0.151	0.000	***	-0.125	0.000	***	-0.089	0.000	***
LSIZE^2	+	0.006	0.000	***	0.008	0.000	***	0.009	0.000	***	0.007	0.000	***	0.005	0.000	***
AZdummy	+	-0.006	0.145	.	-0.004	0.437		0.001	0.872		0.005	0.370		0.004	0.360	
RATEdummy	−	-0.059	0.000	***	-0.096	0.000	***	-0.129	0.000	***	-0.152	0.000	***	-0.168	0.000	***
STOCKOWN	+	0.336	0.000	***	0.453	0.000	***	0.391	0.000	***	0.239	0.007	***	-0.070	0.425	
STDRET	+	-0.020	0.819		0.043	0.664		0.082	0.419		0.107	0.287		0.096	0.314	
ABNEARN	+	0.085	0.000	***	0.078	0.000	***	0.080	0.000	***	0.077	0.001	***	0.084	0.000	***
MTB	−	0.032	0.000	***	0.037	0.000	***	0.032	0.000	***	0.024	0.000	***	0.016	0.000	***
AMAT	−	-0.001	0.062	*	0.000	0.348		0.000	0.363		-0.001	0.090	*	-0.001	0.004	***
TERMSTR	−	-0.008	0.277		-0.013	0.128	.	-0.023	0.012	**	-0.025	0.007	***	-0.017	0.056	*
LEVERAGE	−	-0.473	0.000	***	-0.539	0.000	***	-0.506	0.000	***	-0.420	0.000	***	-0.266	0.000	***
Year fixed effect		Yes			Yes			Yes			Yes			Yes		
Industry fixed effect		Yes			Yes			Yes			Yes			Yes		
Observations		11323			11323			11323			11323			11323		
Adjusted R^2		0.1878			0.2140			0.2183			0.2069			0.1938		

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TABLE 7. Regressions of Maturity Measures on CEO Compensation Incentives: The Effect of External Economic Condition (2SLS method)

This table shows the tow stage least square (2SLS) regression results for 5 specifications. Our sample consists of 11,323 observations representing 1,435 different firms during the time-period from 1992 to 2010. The dependent variables are leverage and the proportion of short-term debt maturing within 1 (ST1), 2 (ST2), 3 (ST3), 4 (ST4), and 5 (ST5) years, respectively. The intercepts are not reported. All variables are defined in Appendix 1 and are calculated at the fiscal year end. The p-values are based on heteroscedasticity-consistent estimation of the covariance matrix of the coefficient estimates defined by White (1980). All specifications include both industry (two-digit SIC) and year fixed effects. ***, **, and * indicates significance at the 1%, 5%, and 10% levels, respectively.

Independent Variables	Predicted Sign	(1) LEVERAGE			(2) ST1			(3) ST2			(4) ST3			(5) ST4			(6) ST5		
		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value	
LVEGA	+	0.001	0.341		0.001	0.644		0.002	0.502		0.000	0.920		-0.002	0.685		-0.005	0.173	
LVEGA*NORMdummy	+	0.072	0.000	***	0.008	0.007	***	0.010	0.005	***	0.015	0.000	***	0.016	0.000	***	0.012	0.001	***
NORMdummy	+/−	-0.005	0.000	***	0.046	0.096	*	0.026	0.382		-0.039	0.206		-0.073	0.017	**	-0.053	0.077	*
LDELTA	+	-0.005	0.003	***	-0.023	0.000	***	-0.025	0.000	***	-0.022	0.000	***	-0.015	0.000	***	0.002	0.692	
LSIZE	−	-0.072	0.000	***	-0.060	0.015	**	-0.132	0.000	***	-0.182	0.000	***	-0.169	0.000	***	-0.155	0.000	***
LSIZE^2	+	0.084	0.000	***	0.004	0.013	**	0.009	0.000	***	0.011	0.000	***	0.010	0.000	***	0.009	0.000	***
AZdummy	+	0.110	0.006	***	-0.027	0.104	.	0.003	0.849		0.028	0.134	.	0.045	0.016	**	0.064	0.000	***
RATEdummy	−	-1.032	0.000	***	-0.033	0.100	.	-0.104	0.000	***	-0.162	0.000	***	-0.201	0.000	***	-0.241	0.000	***
STOCKOWN	+	0.021	0.101	.	0.375	0.000	***	0.441	0.000	***	0.342	0.000	***	0.165	0.081	*	-0.180	0.050	*
STDRET	+	0.018	0.000	***	-0.343	0.182		0.152	0.590		0.498	0.083	*	0.727	0.011	**	1.017	0.000	***
ABNEARN	+	-0.001	0.011	**	0.101	0.000	***	0.072	0.005	***	0.058	0.024	**	0.045	0.082	*	0.036	0.146	.
MTB	−	0.004	0.277		0.035	0.000	***	0.036	0.000	***	0.028	0.000	***	0.017	0.000	***	0.007	0.133	.
AMAT	−	-0.191	0.000	***	-0.001	0.032	**	0.000	0.433		0.000	0.619		-0.001	0.277		-0.001	0.050	*
TERMSTR	−	0.028	0.045	**	-0.007	0.386		-0.014	0.132	.	-0.025	0.009	***	-0.027	0.003	***	-0.020	0.021	**
$\widehat{\text{LEVERAGE}}$	−				-0.768	0.001	***	-0.439	0.068	*	-0.127	0.606		0.147	0.550		0.576	0.015	**
PROFIT		-0.172	0.000	***															
PPE		0.146	0.000	***															
RD		0.000	0.778																
MTAX		0.178	0.000	***															
CASHCOM		-0.013	0.592																
Year and Industry fixed effect		Yes			Yes			Yes			Yes			Yes			Yes		
Observations		11323			11323			11323			11323			11323			11323		
Adjusted R^2		0.5547			0.1404			0.1658			0.1801			0.1807			0.1827		

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TABLE 8. Regressions of Crisis Return on Maturity Measures

This table shows the regression results for 5 specifications. The sample consists of 545 different firm observations which exist in COMPUSTAT form 2006 to 2008. The dependent variables are buy-and-hold return during the period from July 2007 to Dec 2008. The intercepts are not reported. All variables are defined in Appendix 1 and are calculated at the 2006 fiscal year end. The p-values are based on heteroscedasticity-consistent estimation of the covariance matrix of the coefficient estimates defined by White (1980). All specifications include both industry (two-digit SIC) fixed effects. ***, **, and * indicates significance at the 1%, 5%, and 10% levels, respectively.

Independent Variables	Predicted Sign	CRISISRET			CRISISRET			CRISISRET			CRISISRET			CRISISRET		
		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value	
ST1	−	-0.069	0.094	*												
ST2	−				-0.020	0.590										
ST3	−							-0.048	0.177							
ST4	−										-0.080	0.027	**			
ST5	+													0.003	0.947	
SIZE	+	0.023	0.004	***	0.024	0.003	***	0.023	0.004	***	0.022	0.007	***	0.025	0.002	***
STOCKOWN	+	0.718	0.004	***	0.697	0.005	***	0.714	0.004	***	0.722	0.004	***	0.687	0.005	***
MTB	+/−	0.014	0.318		0.011	0.441		0.012	0.403		0.012	0.368		0.010	0.492	
LEVERAGE	−	-0.607	0.000	***	-0.587	0.000	***	-0.612	0.000	***	-0.638	0.000	***	-0.571	0.000	***
RET2006	−	-0.064	0.079	*	-0.062	0.090	*	-0.063	0.082	*	-0.067	0.064	*	-0.060	0.099	*
Industry fixed effect		Yes			Yes			Yes			Yes			Yes		
Obeservations		545			545			545			545			545		
R-square		0.2119			0.2086			0.2108			0.2160			0.2082		

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