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THREE ESSAYS ON CEO CHARACTERISTICS AND CORPORATE BANKRUPTCY

By

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ABSTRACT

THREE ESSAYS ON CEO CHARACTERISTICS AND CORPORATE BANKRUPTCY

Rajib Chowdhury
Old Dominion University, 2020
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Scholarly studies have focused on the impact of managerial characteristics on various corporate activities. Following this stream of literature, this dissertation empirically examines the potential effects of three major Chief Executive Officer (CEO) characteristics, i.e., CEO ability, CEO risk taking behavior induced by compensation structure, and CEO overconfidence on corporate bankruptcies.

Essay 1 examines whether chief executive officers (CEOs) are to be blamed for corporate failure. Using alternative measures of CEO ability, we document that high-ability CEOs are less likely to be associated bankruptcy. Bankruptcy-related high-ability CEOs manage to salvage their post-bankruptcy careers either with the reorganized firms or with other firms experiencing financial difficulties. We document that such CEOs improve the financial performance of the firms they manage during post-bankruptcy career. Jointly, our evidence points out that the incidence of corporate bankruptcy is unrelated to high-ability managers and that it does not have adverse effects on their post- bankruptcy careers.

This study examines whether risk preference inducing CEO compensation structure is associated with corporate bankruptcy. Specifically, using CEO inside debt (i.e., pensions and deferred compensation) and the sensitivity of CEO wealth to stock price (i.e., high CEO delta) as proxies for CEO risk aversion, and the sensitivity of CEO wealth to stock return volatility (i.e., high CEO vega) as a proxy for CEO risk-seeking behavior, we document that CEO compensation structure may mitigate/exacerbate corporate bankruptcy.

Essay 3 investigates the relationship between CEO overconfidence and probability of corporate bankruptcy following Shumway (2001) bankruptcy score. In establishing this behavioral bias of CEOs, we incorporate two additional measure of confidence levels, i.e., moderate and low (diffident). Following Malmendier and Tate (2005) and Campbell, Gallmeyer, Johnson, Rutherford and Stanley (2011), we calculate various confidence level based in CEOs' option holding and exercise behavior. We find that overconfident CEOs – when option holding and exercise behavior are used as proxy – are negatively associated with corporate failure, whereas diffident CEOs are more likely to be associated with firm failure.

This dissertation is dedicated to my parents, my late grandmother, and my cats. Without their relentless and unconditional support, encouragement and love, this journey would have never been possible.

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ESSAY 1: ARE CEOS TO BLAME FOR CORPORATE FAILURE?

EVIDENCE FROM CHAPTER 11 FILINGS

1. Introduction

A recurring research topic in the corporate finance literature is the impact of CEO ability on several aspects of firm operations and shareholder wealth. While a substantial body of literature examines the effects of heterogeneous CEO styles that are fixed over time on firm performance (Bertrand and Schoar 2003; Murphy and Zabojnik 2004) and credit risk assessment (Bonsall IV *et al.* 2016), little attention is given to the impact of CEO ability on firm bankruptcy. Notable exceptions include John, Lang and Netter (1992), Khanna and Poulsen (1995), and Leverty and Grace (2012). Interestingly, the first two exceptions document that firm failure is unrelated to CEO skills and attribute failure to industry-wide factors. On the other hand, Leverty and Grace (2012), based on a single industry, find that CEO ability affects firm performance more conspicuously during times of financial distress, and that efficient CEOs are less likely to be associated with firm bankruptcy. Despite some evidence of a strong positive relation between high levels of CEO ability and improved firm financial performance, it remains unclear whether there is a definitive relation between individual CEO ability and firm failure.

We address this issue by investigating whether bankruptcy filings by large US firms are linked to CEO ability, which Demerjian, Lev and McVay (2012) define as “efficient” managers relative to their industry peers in transforming corporate resources into revenues. CEO ability is considered one of the most crucial intangible assets of a firm. Shareholders expect CEOs to identify, evaluate and eliminate unproductive corporate areas. As stated by Jack Welch: “Good business leaders create a vision, articulate the vision, passionately own the vision, and relentlessly

drive it to completion” (Tichy and Charan 1989). While firm failure is often blamed on management, a high level of CEO ability is critical to firm value and performance. As a result, departure of a high-ability CEO triggers a negative market reaction (Chang, Dasgupta and Hilary 2010). Likewise, hiring a high-ability CEO will bring a positive market reaction. Schoar and Zuo (2016) find that announcement of hiring a CEO who experienced recession during his/her career gets a positive reaction from the market, implying that the market perceives the hiring as unexpected good news for the firm, since the new CEO is assumed to have the required skills to deal with crisis situations. Bertrand and Schoar (2003) document how heterogeneous managerial ability can substantially explain variations in several key managerial decisions, such as capital structure, investment activity, and organizational structure. Since, decisions made by CEOs in each of these areas affect a firm’s short and long-term survival and its future growth potential, it may be argued that high-ability CEOs have better understanding than low-ability CEOs of their firms’ strengths and weaknesses, related industry trends, market demand and supply, and organizational efficiency. Consequently, firms run by high-ability CEOs are expected to be associated with less default risk than firms managed by low-ability CEOs. In other words, low-ability CEOs are more likely to decrease firm value through inefficient management of corporate resources. This leads to the conclusion that CEO inefficiency is more likely to be linked with corporate failure. Given previous findings on the heterogeneous effects of CEO ability (Chang et al. 2010; Baik, Farber and Lee 2011; Pan, Wang and Weisbach 2015), most existing studies shed no light on the relation between CEO ability and corporate default. We focus on this issue and seek to fill this gap in the literature by quantifying the relation between CEO ability and firms that declare bankruptcy.

Evidence from bankruptcy-related incumbent CEOs serving in another firm in the same position suggests that managerial skill is an important attribute in firm survival and success. Eckbo,

Thorburn and Wang (2016) document that only one-third of incumbent CEOs continue their post-bankruptcy career as CEOs – either in the reorganized firm or in a different firm. These authors assume that these CEOs are of higher ability compared to their peers who leave the executive labor market after their companies file for bankruptcy. To address this issue, we also investigate the performance of reorganized firms and outside firms that hire such continuing CEOs. Our results indicate that these outside firms experience negative median industry-adjusted ROA prior to hiring bankruptcy-related CEOs, and positive median industry-adjusted ROA after appointment of these CEOs. We also find that the performance of reorganized firms improves when they continue with their bankruptcy-related CEOs. This justifies the same level and, in some cases, a higher level of compensation for these continuing CEOs. Thus, we provide additional support to Bertrand and Schoar (2003) that managers with higher performance fixed effects receive higher compensation. This also strengthens the notion that CEO ability extends beyond their employment in bankrupt firms, as these CEOs do not experience loss of labor market capital during their post-bankruptcy employment (Eckbo et al. 2016).

By investigating the relation between CEO ability and firm bankruptcy, we attempt to shed light on the following questions: (1) Does higher CEO ability reduce the likelihood of bankruptcy? (To ensure the robustness of this relation we use alternative measures of managerial ability.) (2) Are incumbent CEOs who continue their executive career during the post-bankruptcy period more capable than those who fail to continue their career as top executives? Intuitively, we wish to quantify how much of manager ability can be attributed to firm prosperity. In other words, though the incidence of firm bankruptcy might be associated with factors beyond the control of a CEO, we seek to quantify the specific impact of CEO ability on bankruptcy.

By testing the relation between managerial ability and bankruptcy, we find that a higher level of CEO ability reduces the likelihood of firm bankruptcy. In particular, our results indicate that high-ability CEOs are likely to defy industry-wide factors by virtue of their prudence in superior management of investment activity, resources, and debt obligations. The contribution of this paper to the literature is unique for several reasons. First, to the best of our knowledge, this is the first attempt to quantify the direct relation between managerial ability and bankruptcy by concentrating analysis on a large dataset across different industries. Also, since bankruptcy is a unique corporate event in which it is challenging to separate the managerial role from industry-wide factors, this paper contributes to the literature by providing evidence that the presence of high-ability managers itself can save firms from bankruptcy. Second, we show that the CEO labor market may not be as inefficient as previously considered (Schoar 2007), and it is able to recognize managers with superior skill sets – as evidenced by the fact that some bankruptcy-related CEOs continue as CEOs after bankruptcy filing. Our evidence also demonstrates that reorganized firms led by skilled CEOs experience improved financial performance during the post-filing period. We find a similar pattern for CEOs who left firms that filed for bankruptcy and were hired by other firms as top executives. Further, since the boards of directors of restructured firms and outsider firms are able to identify bankruptcy-related, high-skilled CEOs – irrespective of the performance of their corresponding bankrupt firms – our evidence contradicts the conclusion of Khurana (2004) that the CEO labor market is less efficient in identifying CEO experience and abilities. Third, our study complements the findings of previous research that fails to identify a relation between CEO pay and CEO contribution to firm value (Chang et al. 2010) by showing that high-ability CEOs receive higher compensation even though the firms they previously managed filed for bankruptcy.

Intuitively, this indicates that failure of such firms is dictated by factors beyond the control of high-ability CEOs.

This paper proceeds as follows. Section 2 presents a literature review on CEO ability and its impact on corporate activity and bankruptcy. We also develop a testable hypothesis and discuss the potential impact of CEO ability on bankruptcy. Section 3 describes the data and sample selection. Section 4 presents the results of our empirical analysis and robustness checks. Finally, Section 5 sets forth our conclusions.

2. Literature review and hypothesis development

2.1 CEO ability and firm performance

Our goal is to investigate whether CEO managerial ability is related to corporate bankruptcy. Lang and Stulz (1992) argue for contagion and competitive effects of bankruptcy on firms in the same industry, and this effect is more pronounced in highly leveraged firms, since high leverage may impose high interest payments for an extended period. For instance, Opler and Titman (1994) show a negative relation between high leverage and operating profit during industry downturns. Their finding is supported by Khanna and Poulsen (1995), who show that though managers are blamed for being incompetent and for making poor decisions when firms are in distress, managers of both bankrupt and non-bankrupt firms make similar decisions, and neither type of manager adopts value reducing actions. This implicitly argues that CEO ability does not matter when a firm goes bankrupt. Rather, industry and general economic conditions are to blame for firm distress. From a different strand of the literature, Shleifer and Vishny (1992) show that less leveraged firms benefit from industry downturns by buying assets from highly leveraged firms, and these buying decisions can be attributed to the managerial decisions of less leveraged firms. This indicates the prudence of managers of less leveraged firms in taking advantage of

industry conditions for the benefit of their own firms. We argue that such prudent managers are of high ability in terms of foreseeing future industry and economic conditions, positioning their firms to take advantage of opportunities that arise over time.

Shleifer and Vishny (1992) confirm the findings of Lieberman, Lau and Williams (1990), who show that the performance of the US and Japanese automobile industries is significantly affected by CEO ability. Bertrand and Schoar (2003) show that CEOs have different styles, and these differing styles are relevant to a wide variety of firm decisions, including acquisitions, diversification, dividend policy, interest coverage, and level of capital expenditure. Carmeli and Tishler (2004) find a positive relation between managerial ability and industrial firms' resources, capabilities, and performance. This is in line with Switzer and Huang (2007), who show that CEO quality, as proxied by MBA degree, positively contributes to firm operating performance. Even Chang et al. (2010) show that when a CEO leaves a better performing firm for another firm, the stock price of the CEO's old firm reacts negatively, indicating that investors consider the departure of the CEO a loss of valuable human capital to the departing firm. Demerjian et al. (2012) also document negative market reactions to high-ability CEO departures. Therefore, our findings from the firm and investor perspective highlight that high CEO ability significantly contributes to improved firm performance.

2.2 CEO ability and firm distress

The finance literature shows that CEOs' life experiences shape their management styles (Cronqvist, Makhija and Yonker 2012; Benmelech and Frydman 2015; Cain and McKeon 2016). The literature also provides evidence on how previous career experience influences manager operating style (Schoar 2007). Specifically, managers with recession experience at the beginning of their careers are more likely to follow conservative policies; accordingly, such managers rely

on internal financing. On the other hand, one can argue that CEOs who did not have such unpleasant prior career experiences are more likely to adopt aggressive financial and operating policies. Further, as top managers of similar firms experience a substantial compensation gap (Gabaix and Landier 2008), it can be argued that this compensation gap is attributable to managerial ability regarding cost minimization, revenue maximization, and increasing operating efficiencies. Therefore, it may be possible that because of low CEO ability, some firms face financial distress and eventually go bankrupt. Leverty and Grace (2012) find a correlation between managerial inefficiency and the probability of firm failure. These authors find that when managers are of higher ability, the ultimate cost of bankruptcy is lower. These findings indicate that CEO ability may have a strong impact on the probability of bankruptcy.

Exploring post-bankruptcy CEO employment, Eckbo et al. (2016) show that only one-third of incumbent CEOs find comparable positions after bankruptcy filing. They either continue as CEO of the restructured firms or find employment as CEOs in other firms. These authors' findings also show that the CEO labor market seriously doubts the skill of the most bankruptcy-related CEOs; as a result, approximately two-thirds of bankruptcy-related CEOs eventually leave the executive labor market. Therefore, to further strengthen our point, in line with Schoar and Zuo (2016), we argue that since early career experiences shape managerial style, bankruptcy-related CEOs use their previous experience to develop more advanced skills to cope with highly uncertain situations surrounded by extreme pressure from bondholders and creditors and the possibility of bankruptcy. This distress-handling experience adds to these CEOs' existing competencies. Therefore, we argue that bankruptcy-related CEO experience in handling crisis situations can be viewed as valuable attribute by the executive labor market. Hence, such CEOs have the opportunity to be hired by another firm at the same position. That is, the executive labor market

recognizes that this distress-handling ability is potentially more valuable than the ability of CEOs who never faced such situations. Since incumbent CEOs have been involved in bankruptcies in their respective distressed firms over a relatively longer period, they are more likely to acquire detailed knowledge and expertise about the factors that are more damaging to the financial condition of a firm. That is, they are more skilled in recognizing factors that potentially cause bankruptcy.

The above discussion leads to the prediction that low-ability CEOs are more likely to be associated with bankruptcy filing decisions, while high-ability CEOs can aid firms in recovering from bankruptcy. To the extent that bankruptcy-related experience of high-ability CEOs is considered a valuable attribute for firms going through financial difficulties, such CEOs are expected to be hired by firms going through financial difficulties, with subsequent improved performance.

2.3 Effect of CEO entrenchment on bankruptcy

A potential concern in the context of firm bankruptcy can be managerial entrenchment. The literature on managerial entrenchment and firm performance is contradictory. Shleifer and Vishny (1989) show that managers make themselves entrenched by making specific investments to increase their value to shareholders, extract higher compensation, and reduce the possibility of being replaced. Rose and Shepard (1994) find that there is a positive relation between CEO compensation and diversification, and CEO ability is more associated with compensation premia of diversified firms. Further, this compensation reflects the contribution of the CEO in increasing firm value. Therefore, CEO entrenchment does not destroy firm value. In sharp contrast, Core, Holthausen and Larcker (1999) find that entrenchment and weak firm governance negatively influence the operational and financial performance of firms. In addition, entrenched managers

tend to choose investment and financial policies that are not aligned with the best interests of various stakeholders. For example, Fluck (1999) shows that managers who face the risk of external monitoring pay higher dividends to protect themselves, and managers with high quality investment opportunities make lower dividend payments (Zwiebel 1996). Hu and Kumar (2004) support this by showing that entrenched managers who are likely to adopt suboptimal decisions protect themselves from outsiders by choosing higher payouts. These entrenched managers also engage in higher levels of risk management to reduce financial distress and borrowing costs, rather than maximizing the value of the firm (Kumar and Rabinovitch 2013). This leads to our prediction that CEO entrenchment may eventually be positively related to firm failure.

2.4 CEO post-bankruptcy employment and compensation – CEO ability or CEO power?

Under the managerial power approach, managers have the power to influence the board to obtain favorable compensation that may hurt shareholder value (Bebchuk, Fried and Walker 2002). On the other hand, Bertrand and Schoar (2003) show a positive relation between CEO ability and compensation. These contradictory findings raise the obvious question of whether CEO compensation is determined by CEO ability or power in the context of distressed firms that ultimately face bankruptcy. Further, since some CEOs continue their employment even after filing for bankruptcy, a potential concern may arise about the power of these CEOs. However, since the bankruptcy process has become more creditor-oriented in the last few decades (Ayotte and Morrison 2009), under the managerial ability approach, it is unlikely that creditors would retain low-ability CEOs after a bankruptcy filing. Therefore, following the same logic, one can argue that CEOs who continue to serve their firms after bankruptcy are essentially considered more prudent and essential to the recovery of such firms. Since these CEOs are less likely to be forced to resign, their reputation remains intact, and they can avoid the adverse effects of forced turnover

in the executive labor market. Hence, once they leave firms that went through bankruptcy, they have a greater probability of finding similar jobs due to their ability, with at least the same level of compensation as their prior executive position.

On the other hand, under the managerial power approach, if a CEO leaves for a top executive position at another firm, it is highly unlikely that the new executive will immediately be able to exert power on the board of directors of the new firm to influence his pay. This again strengthens the point that these CEOs are of higher ability compared to those bankruptcy-related CEOs who are unable to find a comparable position at another firm and, therefore, are forced to leave the executive labor market (Eckbo et al. 2016). Therefore, this discussion suggests that managerial ability, as opposed to managerial power, is more likely to have a positive influence on compensation of bankruptcy-related CEOs hired by new firms.

3. Data and methodology

3.1 Data description

Our data are from several sources. The sample starts with 990 Chapter 11 bankruptcy filings over the period 1980–2016 by US firms with book value of assets above \$100 million (measured in 2016 dollars) – whether filed by debtors or creditors. We require firms to be publicly traded. Data for bankrupt firms come from the Bankruptcy Research Database (BRD) of Professor Lynn LoPucki at the University of California at Los Angeles (UCLA). Data for the managerial ability score are from the website of Professor Peter Demerjian of the University of Washington.¹ We collect data for firm-level control variables from Standard & Poor's Compustat and BRD. We collect CEO data from the Standard & Poor's ExecuComp database. For our subsample analysis, we hand collect data extensively from SEC filings, Mergent Intellect by FTSE Russell, Thomson

¹ <http://faculty.washington.edu/pdemerj/data.html>

One database, and various websites. Sample size varies for the independent and control variables because of lack of data availability. For example, when we merge the Managerial Ability (MA) Score Database with ExecuComp, we find that several MA Score data are not available for executives in ExecuComp, especially those who are associated with a firm for less than one year. We calculate *CEO Age* with respect to the corresponding fiscal year. For lagged value of *CEO_Duality*, a dummy variable, we lose observations if a CEO is not associated with a firm more than one year. Since we do not take the lagged value of *Outside_Dummy*, the number of observations for this variable is higher than other CEO-related variables. Similarly, for compensation variables, we take the lagged value of compensation and we do not replace missing compensation information with zero. Therefore, we have different numbers of observations for different types of compensation variables.

3.2 Methodology

3.2.1 Key dependent variables

In our first test described below, we examine the importance of managerial ability to firm bankruptcy filing. Specifically, we investigate whether firms under the helm of managers with low ability are more likely to be associated with bankruptcy. To address this, we use a dummy variable as our dependent variable. This variable takes the value 1 if a firm filed for bankruptcy in a particular year, and all other surviving firms that continued as going concerns are assigned the value zero.

3.2.2 Independent and control variables

In our main analysis, we use three measures of managerial ability. The first is from Demerjian et al. (2012), who estimate manager ability based on efficient use of resources to generate revenues, which requires a two-step procedure to derive the residual of efficiency. Their

estimation is based on the idea that for a given level of input, high-ability managers will generate a higher level of output compared to low-ability managers. Following this idea, we expect that executives with low managerial ability are more likely to be associated with the occurrence of bankruptcy, and vice versa.

Demerjian et al. (2012) use data envelopment analysis (DEA) to assess managerial ability within a given industry. First, these authors estimate DEA efficiency as the ratio of output to input using the following optimization problem:

$$\max_{\theta} \theta = \frac{\sum_{i=1}^s u_i y_{ik}}{\sum_{j=1}^m v_j x_{jk}} \quad k = 1, \dots, n. \quad (1)$$

where s represents output, m represents input, and n represents the number of firms. The output variable is sales, whereas the input variables are: net property, plant, and equipment (PP&E); net operating leases; net research and development (R&D); purchased goodwill, other intangible assets, cost of inventory; and selling, general, and administrative expenses (SG&A), since these input variables directly impact sales. In the second step, DEA efficiency is regressed in a set of key firm-specific characteristics that contribute to managerial ability. These characteristics are firm size, market share, positive free cash flows, foreign currency indicator, free cash flow, number of segments, and firm age. Then, they estimate the following Tobit regression model by industry:

$$\begin{aligned} \text{Firm Efficiency} = & \alpha + \beta_1 \ln(\text{Total Assets})_i + \beta_2 \text{Market Share}_i + \\ & \beta_3 \text{Free Cash Flow Indicator}_i + \beta_4 \ln(\text{Age})_i + \beta_5 \text{Business Segment Concentration}_i + \\ & \beta_6 \text{Foreign Currency Indicator}_i + \text{Year}_i + \varepsilon_i \end{aligned} \quad (2)$$

In the above equation, the rank of residual represents managerial ability.

Our second measure of managerial ability is based on total compensation. Bertrand and Schoar (2003) postulate that since some managers have styles superior to their contemporaries, managers with better styles are expected to receive a premium over the average managerial compensation. In the context of powerful managers, Song and Wan (2018) find strong support for the managerial ability view with respect to the higher level of compensations for high-ability managers. Following Song and Wan (2018), we measure total compensation as the sum of salary, bonus, long-term incentive payouts, other annual compensation, stock option grants (using Black–Scholes valuation method), market value of restricted stocks, and all other compensation earned during a given year. Since distribution of total compensation is highly skewed, we take the natural logarithm of total compensation and lag its value by one year.

Our third measure of managerial ability is based on the organizational capital model developed by Eisfeldt and Papanikolaou (2013). These authors define organizational capital as an intangible asset associated with higher productivity, smaller size, higher firm value, and higher executive compensation. Yildirim and Allen (2017) decompose organizational capital to derive human capital that creates value and residual perquisites and empire building expenses that do not contribute to increased firm value. Following this approach, we derive human capital based on total CEO compensation, as reported in ExecuComp and via the DEF14A form, and use it as our third alternative measure of managerial ability. Specifically, we construct the stock of organizational capital using the perpetual inventory method and derive the following:

$$\text{Organization Capital Stock}_{it} = (1 - \delta)\text{Organization Capital Stock}_{it-1} + SG\&A_{it}/cpi_t$$

where cpi_t is consumer price index and δ is depreciation rate. The initial stock is selected via the following formula:

$$\text{Organization Capital Stock}_{i0} = \frac{SG\&A_{t1}}{g+\delta_0}$$

We use a depreciation rate of 1% and a growth rate of 19%.

In the subsequent analyses, we follow two additional measures of compensation used by Eckbo et al. (2016) to find their relationship with managerial ability. The first measure is percentage change in compensation from three years before bankruptcy filing to three years after finding a new job post-bankruptcy. Based on the positive relation between CEO ability and compensation level (Bertrand and Schoar 2003), Banker, Darrrough, Huang and Plehn-Dujowich (2012) show that the positive association between current salary and future ROE, controlling for current and future performance, indicates CEO ability in predicting future performance. The second measure is the present value of compensation change until age 65, with a discount rate of 10% for all CEOs, and considering the time gap between CEO departure and finding new employment, and including severance pay. Eckbo et al. (2016) argue that this present value represents an upper bound of incumbent CEOs' change in labor market capital.

We include a variety of firm-level control variables to analyze the effects of all our variables on bankruptcy. Specifically, following Bertrand and Schoar (2003) we use a series of accounting variables that relate to firm policy toward investment and to financial, organizational, and corporate decisions. To proxy for investment policy, we use capital expenditure, sensitivity of investment to cash flow, and acquisition policy. To account for financial policy, we include financial leverage, interest coverage, cash holdings, and dividend policy. The control variable related to organizational strategy includes advertising expenditures. Variable description and construction are reported in the Appendix.

4. Empirical Results

4.1: Descriptive Statistics

Table 1.1 reports annual distribution and the characteristics of firm bankruptcy filings. We observe that throughout the 1980s and early 1990s, there is a steady increase in bankruptcy filings, with the number of failed firms reaching a peak during the 2000–2002 period, which coincides with the burst of the dot-com bubble. Again, there is a sharp increase during the 2007–2009 period, caused by the Global Financial Crisis. However, the size of firms that filed for bankruptcy during the 2007–2009 period (ranging from \$5,183.550 to \$29,932.300 million) is much bigger than for firms filing for bankruptcy during the 2000–2002 period (ranging from \$1,110.930 to \$4,508.340 million).

[Insert Table 1.1 Here]

Table 1.2, Panel A shows descriptive statistics for the main variables related to bankruptcy-related CEOs. Definitions of these variables are found in the Appendix. Our independent variable is *Managerial Ability score (MA score)* as estimated by Demerjian et al. (2012). As originally estimated, managerial ability has a mean and median close to 0, since it is estimated as the residual of equation (2). To reduce the loss of *MA score* data, we take the last available *MA score* values of those CEOs for whom *MA score* data is not available in the year of bankruptcy. However, we restrict this up to filing year -3 . For example, if firm X goes bankrupt in 2001, we attempt to identify the *MA score* data for 2001; if the data are not available, we take the *MA score* value for 2000. If the data are still not available, then we take *MA score* for 1999. In this case, the last year we consider is 1998.

The descriptive statistics indicate that the average managerial ability score of bankruptcy-related CEOs is -0.075 , with a median score of -0.092 . The median MA score for the top quartile of CEOs is -0.023 . This indicates that bankruptcy-related CEOs are, in general, of low ability. The average tenure of these CEOs is approximately six years, with an average CEO age of 54 years,

consistent with the average age of the “middle-aged” CEOs found by Serfling (2014). Further, we find that 58.9% of CEOs serve as chairman of the board as well, which is much higher than the percentage of such CEOs in solvent firms (32.4%). Brickley, Coles and Jarrell (1997) report that firms that split CEO and chairman positions generally perform better in terms of cash flow and value than firms that are led by dual leadership. In the context of firms that filed for bankruptcy, the high percentage of dual leadership clearly indicates that duality is more likely to be associated with bankruptcy, as it may have a negative impact on firm financial performance and value.

We also find that approximately 38% of bankrupt firms are associated with outside CEOs, whereas only 15.9% of solvent firms are associated with outside CEOs. With respect to compensation variables, the average cash compensation of bankruptcy-filing CEOs is \$1.149 million, with a median cash compensation of \$0.633 million. On average, bankruptcy-related CEOs receive 89% of their total compensation in cash, much higher than the average proportion of cash compensation (61.5%) for non-bankruptcy-related CEOs. The average Chapter 11–related CEO holds around \$27.442 million in common stock. Collectively, the average total compensation of all the bankruptcy-related CEOs is \$1.633 million, prior to the year of bankruptcy filing.

[Insert Table 1.2 Here]

In Table 1.2, Panel B, we show descriptive statistics related to all non-bankrupt company CEOs, from ExecuComp. The mean MA score of all CEOs is 0.012 – higher than the mean MA score of bankruptcy-related CEOs (-0.075). The difference between the MA score of the two groups of CEOs indicates that managerial ability has an inverse relationship with bankruptcy. The average tenure of non-bankrupt CEOs is close to seven years – slightly higher than the average tenure of bankruptcy-related CEOs. Comparing the average ages of these two groups of CEOs, they appear to belong to the same age group. The average cash compensation of non-bankruptcy-

related CEOs is \$1.674 million, representing 61.5% of their average total compensation. The average value of common stock held by these CEOs is \$136.567 million, whereas the median is only \$6.535 million. This shows that most of these CEOs own a very large amount of the common stocks of the firms they manage, suggesting that stock-based compensation is substantial for our sample of CEOs. In Panel C, we show the difference between the means of our three measures of managerial ability. The differences related to all measures are statistically significant between bankruptcy- and non-bankruptcy-related CEOs.

[Insert Table 1.3 Here]

In Table 1.3, we present Pearson correlations between our primary dependent variable and our variables of interest. Consistent with the managerial ability view, this table reports a negative and significant correlation between our main variable of interest (MA score) and the bankruptcy dummy. We also observe a negative correlation between bankruptcy and CEO tenure. Miller (1991) suggests that long-tenured CEOs tend to be reluctant to change their policies. However, if long-tenured CEOs do not change strategy to adapt to environmental changes, they may cause distress to their firms. In contrast to Miller (1991), the negative correlation suggests that long-tenure CEOs are more likely to be flexible toward their policies to save their firms from potential bankruptcy.

4.2: Multivariate Results

4.2.1. Relation between CEO ability and firm bankruptcy

This subsection addresses the results of our multivariate tests and whether they support our hypothesis, which predicts that firm bankruptcy is associated with managerial ability. We also test the robustness of this relationship using alternative measures of managerial ability.

Table 1.4 presents the results of the logistic regression for seven alternative specifications. We lag all independent and control variables by one year, except the *Outsider CEO* dummy. We estimate all models using CEO and firm-level control variables, as well as industry and year dummies. All coefficients presented in Table 1.4 are probabilities calculated from log odd ratios using natural exponent functions, i.e., e^c where e is the mathematical constant (2.71828) and c is any log odd ratio estimated using the logistic regressions. Hence, the effects of one-unit change in any coefficient on the probability of bankruptcy is calculated as follows: $(e^c - 1) * 100$.

The first model (1) shows the effect of managerial ability on bankruptcy, along with other firm-level variables. Column 1 shows the baseline regression results with MA score, our main measure of managerial ability, derived by Demerjian et al. (2012). Model (1) shows that a one-point increase in MA score reduces the probability of bankruptcy by 71.68%. This high magnitude of the negative and statistically significant relation between managerial ability and bankruptcy suggests that low managerial ability significantly increases the probability of bankruptcy. This result is robust, as it holds in all model specifications controlling for other effects. The results also show that firm leverage is positively and significantly associated with bankruptcy. In economic terms, a 1% increase in firm leverage increases the probability of bankruptcy by 6.13%. Admati, DeMarzo, Hellwig and Pfleiderer (2018) find that since the leverage ratchet effect is always in place, creating asymmetric forces in leverage adjustments, firms in distress are more likely to resist leverage reduction. Therefore, consistent with the evidence of Verwijmeren and Derwall (2010) that firm leverage is positively associated with the probability of financial distress, our results show a positive relation between high firm leverage and likelihood of bankruptcy, i.e., highly leveraged firms are more likely to default.

Research on CEO tenure finds industry-specific (Henderson, Miller and Hambrick 2006) and lifecycle-dependent effects of CEO tenure on firm performance. In other words, CEO tenure has a positive effect on firm performance, but this effect depends on other factors, such as relationship with customers and employees and industry uncertainty (Luo, Kanuri and Andrews 2014). Simsek (2007) argues that the propensity for CEO risk-taking depends on the extent of tenure and idiosyncratic knowledge. When firms with long-tenured CEOs face bankruptcy, this may suggest that these firms have been operated by incompetent CEOs for several years. Therefore, considering the implications of literature, it may be the case that for firms going through a bankruptcy process, CEO tenure may significantly affect firm performance – either positively or negatively.

Scholarly findings on the effects of outsider CEOs on firm performance are contradictory. While one stream of literature finds that outsider CEOs are better when firms need strategic changes (Boeker 1997; Bailey and Helfat 2003), another stream argues against outsider CEOs by showing that, on average, outsider CEOs do not outperform their insider counterparts (Karaevli and Zajac 2012). Following the first stream of literature, boards' desire for rapid strategic changes to save their firms from bankruptcy may be fulfilled by hiring outsider CEOs. However, the latter stream holds that such hiring would be ineffective. Further, the literature on the effects of CEO duality on firm performance has also failed to reach consensus. For example, while Chaganti, Mahajan and Sharma (1985) find no relation between duality and firm failure (in the retail industry), Rechner and Dalton (1991) find a negative relation between CEO duality and ROE, ROI, and profit margin – essentially indicating higher probability of bankruptcy.

In view of the above contradictory findings, in column 2 of Table 1.4, we include additional CEO characteristics. The first additional CEO characteristic we consider is CEO tenure. The

regression results show that CEO tenure is negatively and significantly associated with firm failure. In economic terms, a 1% increase in tenure reduces the probability of bankruptcy by 13.78%. This result appears consistent with the earlier observation that the average tenure of bankruptcy-related CEOs is less than the average tenure of all other CEOs. This is also consistent with previous studies showing that well-matched CEOs continue in their office for a longer period than poorly matched CEOs who either leave voluntarily or are replaced (Allgood and Farrell 2003). The results may also indicate that for firms facing bankruptcy, CEOs voluntarily leave firms or are forced to leave firms because they are unable to make effective strategic changes to prevent bankruptcy. For *Outsider CEOs* and *CEO Duality*, the effects are insignificant. This indicates that when a CEO is of high ability and can make rapid and effective strategic changes, CEO origin (insider/outsider) and power (CEO duality) are unrelated to the probability of bankruptcy. The statistical insignificance of the *Outsider CEO* dummy complements the findings of Zhang and Rajagopalan (2010) that the presence of outsider CEOs may exacerbate the costs of strategic changes more than the benefits in the case of financially distressed firms.

Next, we consider whether entrenched CEOs are more likely to be associated with bankruptcy. Morck, Shleifer and Vishny (1990) suggest that longer tenure may have a positive relation with entrenchment. Other studies find that under conditions of strong governance, CEOs serve for a longer period only when firms perform well (Brookman and Thistle 2009). This may suggest that such CEOs are of higher ability compared to their peers who are more likely to be removed. Brookman and Thistle (2009) identify two specific reasons for the longer tenure of CEOs: (i) superior past performance, even though recent performance has suffered, and (ii) difficulty in finding a suitable replacement. In the first case, if past performance is superior to current performance under the same CEO, then it may be possible that current poor performance

is induced by factors beyond the control of these CEOs. In the second case, difficulty in finding a suitable replacement may indicate that these CEOs possess some extraordinary skills that other CEOs do not. Both arguments favor the existence of high CEO ability. Therefore, we argue that the negative effects of entrenchment, if any, may subside in the presence of high-ability CEOs. To account for the possible impact of entrenchment on bankruptcy, we include the *Entrenchment Index* as determined by Bebchuk, Cohen and Ferrell (2008). The results are given in column (3). The statistically insignificant coefficient of *Entrenchment Index* suggests that the negative effect of entrenchment is diminished in the presence of high-ability CEOs. This finding is in line with Rose and Shepard (1994) that managerial ability may have a much stronger effect on managerial entrenchment under certain circumstances.

Bhagat and Bolton (2008) account for the exogenous relation between governance and firm performance and find that better-governed firms and firms that separate CEO–Chairperson generate better contemporaneous and subsequent operating performance. However, on the other hand, Jensen and Meckling (1995) and Brickley et al. (1997) argue that CEO–Chair duality reduces information collection and processing costs. Therefore, when there is an exogenous shock of increased competition or new market opportunity, the information benefit of CEO–Chair duality is magnified. To account for the impact of governance and dual role of CEOs on firm failure, we use an alternative measure of governance, the *Governance Index* as determined by Gompers, Ishii and Metrick (2003) in column (4) of Table 1.4. The difference between *Entrenchment index (E Index)* and *Governance Index (G Index)* is that the *G index* is based on 24 equally weighted provisions of governance measures as compiled by the Investors Responsibility Research Center (IRRC), whereas the *E index* is based on 6 provisions, as some of the 24 provisions may be correlated. Consistent with *Entrenchment Index*, the results indicate that in the presence of high

managerial ability, the negative impacts of low governance and CEO duality become insignificant – essentially suggesting that CEO ability is, perhaps, the most important factor in reducing the probability of bankruptcy.

Next, we examine whether the presence of high-ability managers influences firm financing choice, as cost of capital can significantly increase the probability of bankruptcy. The pecking order theory suggests that information asymmetry plays an important role in firm financing choices (Myers 1984; Myers and Majluf 1984). Specifically, although the underlying assumption in the seminal Myers papers is that managers are fully committed to delivering value to equity holders, these authors argue that in the presence of asymmetric information, equity issuance could be harmful to equity holders. Recent research shows a strong relation between managerial ability and information asymmetry and its consequences on firm choice of capital. Chemmanur, Paeglis and Simonyan (2009), for example, argue that firms with higher-ability managers tend to reduce information asymmetry, which in turn broadens their financial choices by way of easy access to the equity market. Therefore, firms with high- (low-) ability managers are likely to rely more (less) on equity (debt), because of lower information asymmetry, which reduces the adverse selection cost of equity. To shed light on this relationship, in column (5) we interact MA score with firm leverage. The negative effect of higher managerial ability on bankruptcy persists at the 1% significance level. However, the coefficient of the interaction between MA score and firm leverage is negative but insignificant. The relatively small coefficient of leverage (0.0704) indicates that firm leverage is less likely to increase the probability of default when firms are led by high-ability managers. That is, high managerial ability significantly mitigates the positive relation between higher leverage and the propensity for bankruptcy.

We then examine whether the interaction between CEO and firm leverage has any bearing on the probability of bankruptcy. Previous studies of the effects of CEO entrenchment on firm leverage are contradictory and do not provide a clear picture on how entrenched managers' reliance on financing choice impacts firm leverage (Berger, Ofek and Yermack 1997; Benmelech 2006; John and Litov 2010). While Fama (1980) argues that entrenched managers prefer less leverage than optimal to protect undiversified human capital, Harris and Raviv (1988) and Stulz (1988) argue that entrenchment induces managers to increase leverage beyond the optimal point to inflate the voting rights of their equity. Further, since the discrepancy between a firm's liquid assets and borrowing can cause firm distress (John 1993), we examine the combined impact of CEO entrenchment and firm leverage on the probability of bankruptcy. In column (6), we present the result of interacting CEO entrenchment and firm leverage in the context of bankruptcy. Our finding suggests that when CEOs are of high ability, the combined effect of entrenchment and leverage does not statistically significantly impact bankruptcy. When we substitute the *entrenchment index* with the *governance index* in column (7), we find similar results. Therefore, in the context of firms going through bankruptcy, our analysis indicates that even though a CEO is entrenched and relies more on debt financing, by virtue of his high level of ability, the probability of bankruptcy can be mitigated.

The above result that CEO ability is negatively associated with firm default is consistent with the prediction of the managerial ability hypothesis. Contrary to previous evidence (John et al. 1992; Khanna and Poulsen 1995) that firm failure is unrelated to managerial ability, our findings suggest that firms under the helm of high-ability managers are less likely to experience bankruptcy.

[Insert Table 1.4, about here]

Next, we examine the robustness of our results, as presented in Table 1.4, using alternative measures of managerial ability. We use CEO compensation as our first alternative measure of managerial ability. Bertrand and Schoar (2003) show that high-ability managers receive higher compensation and claim that they are generally associated with better-governed firms. The managerial ability view argues that more talented managers enjoy more power (Graham, Li and Qiu 2012), and since more talented managers are matched with larger firms (Rosen 1981; Gabaix and Landier 2008; Baranchuk, MacDonald and Yang 2011), they are given more authority and compensation, as their contribution to firm performance is higher. Contrary to the managerial talent view, the finance literature argues that CEO power is positively associated with the CEO compensation premium (Core et al. 1999; Murphy and Zabojnik 2004; Morse, Nanda and Seru 2011). Specifically, it is argued that more powerful CEOs receive a higher compensation premium than less powerful CEOs. However, considering the opposite positions of the managerial ability view and managerial power view, Song and Wan (2018) find that high-ability CEOs receive a much higher compensation premium than powerful CEOs. Their evidence suggests that more talented CEOs have greater bargaining power because of their superior managerial skills, not because of their rent-extracting capacity. Therefore, in Table 1.5, as in Song and Wan (2018), we use CEO total compensation as an alternative measure of managerial ability. Consistent with the evidence reported in Table 1.4, columns (1) and (2) show that CEO total compensation is negatively and significantly associated with firm bankruptcy. However, comparing the coefficients of *Total Compensation* with the coefficients of *MA Score*, reported in Table 1.4, the *Total Compensation* coefficients are smaller. For example, in column (1), the coefficient of *Total Compensation* is -0.0799 (at the 1% level), indicating that for a 1% increase in total compensation, the probability of bankruptcy decreases by 7.99%, in comparison to 71.68% when *MA Score* is

used as the managerial ability measure. This difference suggests that *MA Score* is a more appropriate measure of managerial skill than a higher level of CEO compensation in averting the likelihood of bankruptcy.

Examining the coefficients of other statistically significant control variables, we observe that their economic values are comparable in both Tables 1.4 and 1.5. Specifically, the coefficients of *Cash Flow* and *Investment* are negative and significant, as shown in Table 1.4. Consistent with the evidence reported in Table 1.4, we find that the adverse effects of the CEO entrenchment index and governance index are statistically insignificant. When we interact *Total Compensation* with *Firm Leverage* and *Leverage* with *Entrenchment Index*, the coefficients of the interaction terms remain insignificant, though the coefficient of our main variable of interest, i.e., the coefficient of total compensation, continues to be negative and statistically significant. In sum, these results suggest that high-compensation CEOs are more likely to prevent bankruptcy by virtue of their higher level of ability. Moreover, the results provide strong support for the managerial ability view, which suggests that high CEO compensation mirrors CEO talent rather than rent-extracting capacity.

[Insert Table 1.5, about here]

Next, we use a third measure of managerial ability to ensure the robustness of our previous results. This measure is based on the concept of organizational capital put forward by Eisfeldt and Papanikolaou (2013)². The results of this measure are presented in Table 1.6. Overall, the results are consistent with our main findings. Specifically, we find a negative and statistically significant relation between human capital and firm bankruptcy. Even through the economic value of the

² Yildirim and Allen (2017) decompose organizational capital (Eisfeldt and Papanikolaou 2013) into human capital that increases firm value and a residual component that does not contribute to firm value. We use the human capital component as our third proxy for managerial ability.

coefficient of CEO *Human Capital* is smaller compared to the coefficients of the other two measures of managerial ability (*MA Score* in Table 1.4 and Total Compensation in Table 1.5), its sign suggests that CEOs with superior human capital are more likely to prevent firm bankruptcy, as they are motivated by the need to protect the value of their human capital and reputation in the competitive executive labor market. Taken together, our evidence shows that the negative relation between managerial ability and bankruptcy remains robust regardless of which measure of managerial ability is used.

[Insert Table 1.6, about here]

4.2.2 *Incumbent CEO ability and post-filing median compensation change*

Having shown that managerial skill reduces the probability of bankruptcy, the natural question is how the executive labor market values the ability of managers engaged in a bankruptcy. Since Eckbo et al. (2016) find that two-thirds of bankruptcy-related incumbent CEOs leave the executive labor market, and the remaining one-third continue their executive careers, examining compensation changes around the bankruptcy event allows us to shed light on how the executive labor market values the managerial abilities of CEOs involved in a bankruptcy and the abilities of those who leave to take a similar position in another firm³. To address this issue, we examine the relation between managerial ability and compensation change 3 years before and 3 years after Chapter 11 filing for incumbent CEOs in charge of reorganization and CEOs who depart for another firm at the same position.

We also compute the present value of compensation change (new compensation minus old compensation – either in the reorganized firm or in the new firm) until the age of 65, discounted

³ Earlier studies (Harris and Holmstrom (1982) and Lazear (2012)) suggest that managers who leave one company to take a similar position in another company are of higher ability. Eckbo et al. (2016) argue that the one-third of incumbent CEOs that handle bankruptcy-related reorganizations are of higher quality.

at 10%, considering the time gap between departure and new employment, including severance pay. Since we focus on the career of incumbent CEOs during the post-bankruptcy filing period, we identify the post-bankruptcy employment of these CEOs. We also identify the actual total compensation from ExecuComp, proxy statements, and 10-Ks for those CEOs who either continue as CEO of the reorganized firms or join different public firms. We follow Eckbo et al. (2016) to determine the post-bankruptcy compensation of incumbent CEOs who continue as CEO in restructured firms and use average total compensation over Emergence Year +1 and Emergence Year +2. For Emergence Year +2 and Emergence Year +3, we take the actual total compensation. For incumbent CEOs who depart for a different public firm at the same position, we take average total compensation of the hiring year and the following year. This process is followed to smooth the effect of signing and restructuring bonuses.

For each bankruptcy-related CEO, we collect total CEO compensation for three years prior to the year of bankruptcy. We identify only 75 incumbent CEOs with compensation data for three years prior to bankruptcy filing from ExecuComp. Therefore, for the remaining 333 incumbent CEOs, we hand collect compensation data from SEC filings (proxy statements, 10-Ks). We also collect data on restricted stocks from proxy statements and 10-Ks. In computing total compensation of these CEOs based on proxy statements and 10-Ks, we define CEO total compensation as the sum of salary, bonus, long-term plans and other annual cash compensation, restricted stock awards, Black–Scholes values of options grants, and all other compensation as in Eckbo et al. (2016). We follow Core and Guay (1999) to value options grants using Black and Scholes. Stock return volatility is measured using annualized standard deviation of daily returns over the fiscal year of the grant. When stock return data is available for fewer than 50 days, we use median volatility for all ExecuComp firms in the grant year. We winsorize volatility at the 5th

and 95th percentiles for every year. Dividend yield is computed by taking the ratio of cash dividends to fiscal year-end stock price. Based on the options' expected maturity, we use corresponding Treasury bond yields. Following the above procedure, we identify the total compensation of 408 bankruptcy-related incumbent CEOs. For CEOs with no compensation data (both in the ExecuComp and SEC filings) either in filing year -1 or year 0 , we take the immediately prior available compensation data for that particular year. In other words, if filing year -1 data are missing, then year -2 compensation data are used as year -1 compensation. Similarly, if year 0 compensation data are missing, then year -1 data are used for year 0 . Following this procedure, we identify compensation data for 237 incumbent CEOs. Of these incumbent CEOs, 56 are founders of the firms that file for Chapter 11. We identify the post-bankruptcy salary of incumbent CEOs who continue as executives in the restructured firm and/or in a different public firm. For incumbents who join private firms as CEOs, we identify the firm names from the Factiva, Google, LinkedIn, and RelationshipScience websites. Then we estimate their compensation data following Eckbo et al. (2016). We determine the sales data from the Mergent Intellect database of FTSE Russell. For private firms with missing data for a particular year of interest, we identify new compensation based on two-digit SIC industry and sales-matched firm in ExecuComp. For example, if we need sales data for private firm Y for year 2002 and the earliest available sales data from Mergent Intellect for that private firm are for 2010, then we find a firm in ExecuComp under the same SIC code with corresponding dollar value of sales closest to the sales of the private firm in 2010. Then we find the total compensation of the CEO of the ExecuComp firm in 2002 and discount it by 20% as a private firm discount (Gao, Lemmon and Li 2010; Gao and Li 2015). Following Eckbo et al. (2016), we restrict the dollar value of sales within a range of 30%. When sales data are not available, we use total assets of the private firm and apply the same procedure

as above. The above procedure leads to identification of 178 incumbent CEOs with both compensation information and MA score data. Finally, all the compensation variables are converted to constant 2013 US dollars using the Consumer Price Inflation (CPI) index.

Henderson (2007) argues that in case of bankrupt firms, it is believed that its existing management will be more valuable because it is considered to have superior firm-specific knowledge than managers hired from outside. Therefore, incumbent managers are in a more solid position to claim lucrative compensation packages during bankruptcy. This may indicate that skilled incumbent CEOs are in a more suitable position to exercise their rent-extracting power. However, Ayotte and Morrison (2009) argue that different classes of creditors (in terms of seniority) may object to the management compensation package during bankruptcy. Based on this perspective, we argue that if existing CEOs are not of high ability, they will be quickly removed, as these CEOs might lengthen the reorganization process, and creditors may have to incur additional losses. Therefore, the fact that some reorganized firms continue with the same CEOs with at least the same level of compensation after filing for bankruptcy strongly supports the managerial ability view. At the same time, incumbents of firms that file for bankruptcy who leave for a new executive position with another firm do not experience median compensation change (Eckbo et al. 2016). This indicates the superior ability of these CEOs, as it is unlikely that they can obtain favorable compensation contracts unless they have much superior management skills. In sum, the higher compensation of incumbent CEOs seems to reflect their ability premium rather than their rent-extraction ability.

Table 1.7 presents the results. As expected in columns (1) and (2), high-ability CEOs, based on MA score, experience a positive and significant percentage change in compensation three years before bankruptcy filing to three years after reorganization or starting a CEO position in a different

firm. Compensation change is the difference between new compensation and old compensation. In economic terms, a 1% increase in *MA Score* increases CEO compensation by 3.434% and 3.615%, respectively. In columns (3) and (4), using the present value (PV) of compensation change as the dependent variable, we observe the same positive and significant pattern between managerial ability and PV of compensation change. Interestingly, columns (3) and (4) show that incumbent CEOs who served as CEOs in other firms prior to joining the bankrupt firms (*Prior CEO*), experience a negative and significant PV compensation change. This seems to suggest that the CEO labor market revised downward its view about the managerial abilities of CEOs with prior top executive experience. That is, the CEO labor market had much higher expectations for CEOs with prior executive experience, irrespective of industry and market conditions, that failed to be fulfilled. We also find that CEO duality is negatively and significantly associated with CEO compensation changes. Since the board serves as shareholder representative (Fama and Jensen 1983), we argue that these CEOs are perceived to take more responsibility for bankruptcy filings. The above two findings also indicate the efficiency of the CEO labor market (Ang, Lauterbach and Vu 2003). We find that when Chapter 11 firms file for prepackaged bankruptcy, the associated incumbent CEO's future compensation change is positively affected – provided that the incumbents continue their post-bankruptcy career as CEOs. This might indicate superior negotiation abilities of these CEOs, as they are not only focused on the wealth maximization of equity holders, they are also concerned about the interests of creditors. Consequently, CEO compensation-based results provide empirical support for the view that incumbent CEOs and CEOs who left for a different firm at the same position do not experience losses; instead they realize significant compensation gains, reflecting their superior managerial ability, rather than their rent-extraction ability.

[Insert Table 1.7 here]

4.2.3 Incumbent CEO ability and CEO tenure in the bankrupt firm

This subsection presents a test to find the relation between CEO ability and tenure in bankrupt firms after filing for Chapter 11. Skeel Jr. (2003) finds that during the 1990s, creditors became more powerful in terms of reducing management entrenchment and the associated decrease in firm value. This author also argues that this high bargaining power of creditors stems from debtor-in-possession (DIP) financing⁴ and key employee retention plans (KERPs). Therefore, creditors become more aware of the value of existing management because incumbent CEOs have superior knowledge about the current business, and there are many associated problems arising from hiring new CEOs in term of gaining knowledge about the new firms they are appointed to run. Following this argument, Evans III, Luo and Nagarajan (2013) find that CEO ability is significantly and positively associated with CEO retention.

Examining the relation between MA score and the tenure of bankruptcy-related CEOs in bankrupt firms, we find a positive and significant relation between MA score and number of years incumbent CEOs continue in office after filing for Chapter 11, in both regression specifications, as shown in Table 1.8. Specifically, column 1 shows that a 1% increase in MA score is associated with a 13.58% increase in the tenure of incumbent CEOs in firms that file for Chapter 11. When these incumbent CEOs are the founders, as reported in column 2, the effect is stronger: a 1% increase in MA score is associated with a 14.06% increase in tenure. The high values of the MA score coefficients indicate the high reliance and trust that the board, and especially creditors, place

⁴ Debtor-in-possession financing (DIP financing) is a special kind of financing meant for firms that are financially distressed and in bankruptcy. Only firms that have filed for bankruptcy protection under Chapter 11 in the United States and the CCAA in Canada can utilize it. This usually occurs at the start of a filing. It is used to facilitate the reorganization of a debtor-in-possession (the status of a company that has filed for bankruptcy) by allowing it to raise capital to fund its operations as its bankruptcy case runs its course. DIP financing is unique from other financing methods in that it usually has priority over existing debt, equity, and other claims.
<https://www.investopedia.com/terms/d/debtorinpossessionfinancing.asp>

on the ability of CEOs to reorganize firms subsequent to filing for Chapter 11. The negative and statistically significant coefficient of *CEO Age* suggests that younger (older) incumbent CEOs are more (less) likely to continue serving in the executive office. Following the arguments of Skeel Jr. (2003), we also posit that since creditors of large firms face substantial financial losses in case of firm reorganization, they tend to blame managers for their incompetence in running such large organizations. Therefore, creditors should exert their power to keep only the best CEOs that they believe have the competence to reorganize their firms efficiently in terms of saving money and not investing in value-destroying projects. Therefore, the findings of our study add to the literature by showing that bankruptcy does not necessarily destroy CEO reputation and career prospects, and the best CEOs have a higher chance of saving their executive careers, even though they are associated with firms that filed for bankruptcy.

[Insert Table 1.8 here]

4.2.4 Incumbent CEO ability and industry-adjusted ROA of firms run by bankruptcy-related CEOs

This section examines the impact of MA Score on the performance of bankruptcy-related firms in the post-Chapter 11 period. Based on our previous findings, we expect a positive and significant relation between managerial ability and the financial performance of reorganized firms run by high-ability (MA score) incumbent CEOs. A similar relationship is expected for bankruptcy-related CEOs hired by other (outside) firms. That is, to the extent that managerial ability matters, both reorganized and outside firms run by high-ability CEOs are expected to improve their financial performance during post-bankruptcy period employment.

The literature shows that boards are efficient in filtering out industry- and market-related factors from firm performance when considering the retention or dismissal of current CEOs (Warner, Watts and Wruck 1988; Morck et al. 1990; Jenter and Kanaan 2015). In the 1980s, the

Bankruptcy Code allowed incumbent management to run a business under their own control even after firms filed for Chapter 11. The Bankruptcy Code gives management the right to propose reorganization plans (Hotchkiss 1995). Hotchkiss finds that such power provided by the Bankruptcy Code enables management to continue unprofitable businesses. As a result, 40 percent of sample firms continue to incur losses over three years following bankruptcy and 32 percent of sample firms eventually refile for bankruptcy. However, in sharp contrast, Ayotte and Morrison (2009) show that firms that filed for Chapter 11 in 2001 experienced substantial creditor control in the reorganization process – with management and equity holders exercising minimal control. Since creditors are likely to retain only high-ability CEOs for their in-depth, firm-specific knowledge (Skeel Jr 2003), we predict that if high-ability CEOs are retained to carry out the reorganization process, they should have a positive impact on the performance (ROA) of the firms they run after filing for bankruptcy.

Further, Coughlan and Schmidt (1985) and Parrino (1997) indicate that firms that suffer from poor performance are more likely to hire CEOs from outside, and that the preference for hiring an outsider CEO is higher for larger firms than for smaller firms (Schwartz and Menon 1985). In more recent times, firms have shown an increasing preference for hiring outsider CEOs because of the increasing importance of general knowledge over firm-specific knowledge (Murphy and Zabojsnik 2007). In line with this finding, we argue that bankruptcy-related incumbent CEOs possess more distress-handling knowledge than CEOs who never experienced such distress over their careers. Therefore, incumbent CEOs who face bankruptcy for reasons beyond their control and get the chance to continue as CEOs during the post-filing period are considered to have superior management skill by the CEO labor market. Parrino (1997) shows that when the board decides to replace an existing poor-performing CEO, the decision is accompanied by the

availability of a suitable outside candidate. These findings suggest that to the extent boards can identify CEO fixed effects when evaluating potential candidates, they are likely to appoint the most suitable CEOs from the available pool of CEOs. Farrell and Whidbee (2003) show that the board of a firm is more likely to appoint a CEO who is expected to bring changes in firm policies and strategies. With their superior distress-handling ability, bankruptcy-related incumbent CEOs hired by other firms are more likely to take effective action to revive the firms they are appointed to run, since they may not want to lose such a second chance after their reputation is negatively affected by bankruptcy. In line with Schoar and Zuo (2017) regarding how early career experiences influence future managerial behavior, we may posit that incumbents who continue with the reorganized firms, as well as those who are hired by other firms, are more likely to get hired by firms that need a more conservative management style, because these firms are also likely to go through difficult times. Therefore, these CEOs are expected to have a higher tendency to save money by way of reducing major expenditures, maintaining lower leverage, and working capital, the ultimate effect of which will be reflected in the return on assets of these firms. All these lead us to examine how these incumbent CEOs affect the performance of either the reorganized firms in which they continue their employment or in other firms that hire them.

Table 1.9 presents results on how these incumbent CEOs affect the performance of both reorganized firms and outsider firms that hire them after leaving their executive positions in firms that filed for bankruptcy. We identify 71 incumbent CEOs along with their corresponding MA score data in the year of bankruptcy and their subsequent employment information. Out of 71 incumbent CEOs, 58 continued serving in their CEO positions with the restructured firms, while the remaining 13 continued their executive careers at different firms. The results show that MA score is positively and significantly associated with industry-adjusted ROA of these firms.

Specifically, as shown in column (1), a 1% increase in MA score is associated with a 3.31% increase in industry-adjusted ROA. We also find that the *Prepack* bankruptcy binary variable, which indicates that a reorganization plan is filed jointly with the bankruptcy petition, is positively associated with industry-adjusted ROA, indicating the negotiation efficiency of these CEOs. Our results also show that the industry-adjusted ROA of Chapter 11 firms that receive DIP financing worsens. The coefficient of the DIP loan dummy variable is negative. Though proponents of DIP financing argue that it enables bankrupt firms to invest in positive NPV projects, thereby increasing the likelihood of reorganization and reducing the time spent under Chapter 11 (Dahiya, John, Puri and Ramírez 2003), our findings indicate that when CEOs receive DIP financing, the industry-adjusted ROA of reorganized firms deteriorates. That is, DIP financing works as in detriment to the future profitability of the reorganized firms. This reinforces the argument regarding overinvestment problems that motivate managers to undertake risky and possibly negative NPV projects (Gertner and Scharfstein 1991; Triantis 1993). In sum, we find that CEOs who survive a bankruptcy perform consistently better, regardless of whether they continue their careers in reorganized firms or in other firms. Our results may also extend the findings of Ayotte and Morrison (2009) that since creditors now have more control in Chapter 11 proceedings, they are more likely to identify the best CEO candidates to successfully reorganize firms.

[Insert Table 1.9 Here]

4.2.5 Graphical evidence – incumbent CEO ability and industry-adjusted ROA of firms run by bankruptcy-related CEOs

This subsection presents graphical evidence of the improved industry-adjusted ROA of firms that continue with the same CEO after reorganization and of outside firms that appoint bankruptcy-related incumbent CEOs. Figure 1 shows median industry-adjusted ROA for bankrupt

firms that eventually reorganize and continue with the same CEOs. We identify 58 CEOs who continue as CEOs of reorganized firms. As shown, industry-adjusted ROA improves one year after bankruptcy, though industry-adjusted ROA remains in negative territory. Based on a sample of firms from 1979 to 1988, Hotchkiss (1995) shows that a substantial number of firms that emerge from bankruptcy require further restructuring. However, in contrast to the 1980s, when management had more power during the bankruptcy process, Ayotte and Morrison (2009) show that during the 1990s, secured creditors become more powerful in the negotiation process and in making decisions as to whether to retain bankruptcy-filing CEOs, which ultimately led to the retention of higher-ability CEOs. Consistent with this notion, our analysis shows that the industry-adjusted performance of these firms improves three years after reorganization.

Figure 2 shows industry-adjusted ROA of outside firms run by CEOs with bankruptcy experience in their previous firms. We identify 13 such CEOs hired by outside firms. Among these CEOs, 11 remained with their bankrupt firms during the bankruptcy proceedings. In fact, these outside firms that hired CEOs with bankruptcy experience are those that had been experiencing a decline in their median industry-adjusted ROA over a period of three years prior to the hiring of these CEOs. After hiring these bankruptcy-related CEOs, these firms experienced positive median industry-adjusted ROA over a three-year period subsequent to the year of hiring. Our finding provides additional evidence on top of previous studies that the accounting measure of firm performance deteriorates before CEO turnover and improves thereafter when firms hire outside CEOs (Huson, Malatesta and Parrino 2004). This might be associated with divesting poorly performing business units of the hiring firms (Weisbach 1995), though we do not study hiring firms' divestments directly. Our finding is also in line with Schoar and Zuo (2016) that CEOs who experience downturns early in their careers gain distress-handling experience and come to possess

the necessary skillsets to improve firm performance. The findings also reinforce the idea of market efficiency in the response of hiring distress-related CEOs as unexpected good news for firms.

[Insert Figures 1 and 2 Here]

4.2.6 Role of institutional investors in determining post-bankruptcy compensation of incumbents

This subsection examines the effects of institutional holdings on the future compensation of CEOs – in both reorganized firms and in outside firms that hire these CEOs. The literature on the effects of institutional investors on CEO compensation has produced mixed results. On one hand, Hartzell and Starks (2003) show that through ownership concentration, institutional investors can influence managerial compensation by way of pay-for-performance. Specifically, managers of firms with higher concentration of institutional ownership receive lower levels of compensation, controlling for industry, size, investment opportunities, and recent firm performance. However, Kaplan and Minton (2012) find no significant relation between institutional ownership and CEO compensation. In view of these contradictory findings, in the context of bankrupt firms, institutional ownership may influence CEO compensation levels. For firms that file for bankruptcy, since institutional investors do not sell their holdings heavily until the year prior to bankruptcy (Precourt & Oppenheimer 2015), these investors are likely to suffer major losses. Therefore, consistent with David, Kochhar and Levitas (1998), institutional investors with higher holdings in bankruptcy firms are likely to lower CEO compensation level. Table 1.10 shows the effects of institutional investor holdings on the compensation change of incumbent CEOs of firms that previously filed for bankruptcy. Here we consider all incumbent CEOs who assume any executive position during their post-bankruptcy careers. The results show that, in general, institutional holding is negatively associated with compensation change. However, the positive effect of managerial ability on compensation is still pronounced. This again substantiates

our main finding that the positive effects of high ability on compensation can defy other factors that may reduce executive compensation. The results also show that when incumbent CEOs file for prepackaged bankruptcy, their compensation is positively impacted.

[Insert Table 1.10 Here]

5. Conclusion

This study examines the relation between CEO ability and bankruptcy, and particularly whether low-ability CEOs can be blamed for firm failure. Our study also addresses how the executive reputation of bankruptcy-related CEOs is affected after bankruptcy filing. We shed light on these issues using three proxies of CEO ability: *Ma Score*, *Total Compensation*, and *CEO Human Capital* and document that high (low) CEO ability reduces (increases) the probability of bankruptcy. We find that higher (lower) CEO ability reduces (increases) the likelihood of bankruptcy. Our results are robust to alternative measures of managerial ability.

We also find strong evidence that high-ability incumbent CEOs continue their employment in the post-bankruptcy period with higher compensation. Moreover, the fact that some outside firms employ bankruptcy-related, high-ability CEOs suggests that CEOs with distress-handling experience add to their existing competencies. Therefore, high-ability CEOs manage not only to retain their managerial reputation through comparable employment, but also experience considerably higher compensation. In sum, the evidence suggests that highly compensated CEOs are more likely to prevent bankruptcy by virtue of their higher managerial abilities. Moreover, our evidence from bankruptcy filings, consistent with the managerial ability view, suggests that high CEO compensation mirrors talent rather than CEO capacity for rent-extraction.

We also find that reorganized firms run by high-ability incumbent CEOs experience improved financial performance subsequent to Chapter 11 filings. Improved financial performance

is also realized by outside firms that hire high-ability CEOs with bankruptcy experience. Our findings add to the literature by showing that bankruptcy does not necessarily destroy CEO reputation and career prospects. Therefore, the most talented CEOs have a higher chance of saving their executive careers, even though they have previously been associated with firms that filed for bankruptcy.

Finally, our evidence complements the findings of previous research that fails to identify a relation between firm value and CEO pay (Chang et al. 2010) by showing that high-ability CEOs receive higher compensation even though the firms they previously managed filed for bankruptcy. Intuitively, this indicates that the failure of these firms is dictated by factors beyond the control of high-ability CEOs. The empirical evidence on the negative association between institutional holdings and compensation change supports the literature. Moreover, complementing previous findings, our results show that the positive impact of high managerial ability on compensation persists even in the presence of factors that are likely to reduce compensation level.

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Table 1.1: Annual distribution of bankruptcy filings and firm characteristics.

The table reports mean and median values of sales, book value of total assets, and book value of total liabilities in the year prior to bankruptcy filing (millions of US dollars). In a prepackaged bankruptcy filing, a firm files a plan of reorganization jointly with its bankruptcy petition, i.e., the debt contract of the firm has been accepted by the creditor prior to the beginning of the bankruptcy process. In a pre-negotiated plan, the debtor and creditor agree upon the term of a plan and contractually bind themselves through an agreement without being engaged in voting process of Section 1126 of the bankruptcy code¹. A free fall chapter 11 is a surprise filing of bankruptcy in the bankruptcy court. The sample contains large public US firms filing for Chapter 11 from 1980 to 2016.

Filing Year	N	Sales (\$ Million)		Total Assets (\$ Million)		Total Lia. (\$ Million)		Bankruptcy Type		
		Mean	Median	Mean	Median	Mean	Median	Pre-negotiated	Prepack	Free Fall
1980	3	541.574	288.318	328.29	177.991	208.049	121.043	0	0	3
1981	5	308.19	207	698.882	446.085	712.136	368.971	0	0	5
1982	13	790.086	391.123	661.074	473.756	513.81	347.325	0	0	13
1983	5	1557.55	1427.02	2204.41	284.836	2067.81	201.497	0	0	5
1984	6	815.424	386.796	649.233	228.358	484.431	308.307	0	0	6
1985	7	567.173	370.897	556.254	389.516	464.088	293.66	0	0	7
1986	10	1071.56	202.648	1095.27	436.067	896.853	352.36	0	1	9
1987	7	4983.93	416.796	5366.49	518.26	3303.68	493.171	0	0	7
1988	12	664.961	362.699	3411.58	412.238	3239.84	433.409	0	0	12
1989	16	724.568	467.696	2150.42	1480.15	2523.38	2728.01	1	0	15
1990	30	1222.39	390.2	1230.67	556.824	1291.75	525.6	1	1	28
1991	37	730.962	498.364	994.364	427.461	1035.4	526.185	3	3	31
1992	32	959.246	518.803	1178.31	452.697	1177.15	503.58	2	9	21
1993	23	589.406	440.97	465.781	313.667	572.708	258.97	3	8	12
1994	11	606.151	508.281	405.666	346.645	398.259	276.265	1	4	6
1995	17	988.137	409.5	1081.85	665.391	1053.95	596	2	3	12
1996	14	1079.07	725.75	641.55	509	573.298	490	4	3	7
1997	16	1031.9	407.762	875.433	427.482	841.286	408.84	4	2	10
1998	30	534.491	385.416	772.598	374.1	775.751	374.186	6	3	21
1999	40	845.38	394.44	1203.87	554.583	1080.93	471.52	11	3	26
2000	70	1173.63	555.808	1110.93	472.764	1081.61	458.5	11	4	55
2001	89	2205.72	580.897	2620.58	808	2259.91	644.559	18	0	71
2002	75	2364.38	567.164	4508.34	872.9	3495.3	888.088	23	6	46
2003	55	1225.42	615.738	1674.73	635.15	1670.76	670.902	9	4	42
2004	29	981.083	436.817	996.489	476	973.613	517	9	4	16
2005	25	3607.09	716.2	5817.44	657.195	6025.97	569.73	2	2	21
2006	13	1419.1	472.045	1386.85	452.145	1305.57	541.92	5	0	8
2007	13	849.475	775.287	5183.55	871	4995.56	1390	1	3	9
2008	34	3295.1	880.833	29932.3	1038.65	28678.36	1276	4	2	28
2009	81	3828.36	841.39	5686.05	1003.98	6723.43	1240.33	25	4	52
2010	26	785.932	244.187	2202.6	944	2262.86	1016	6	6	14
2011	22	1673.8	387.161	4249.27	649.004	4168.2	623.627	6	3	13
2012	23	957.627	557.2	1862.1	690.304	1749.64	558.801	4	4	15
2013	24	659.149	444.446	1081.78	502.593	1142	571.216	6	8	10
2014	16	1206.43	390.732	3889.58	1290.83	4643.94	1070.86	6	3	7
2015	23	1152.23	569.428	2898.63	1591.2	2907.8	1378.97	11	1	11
2016	38	1127.51	797.555	2403.04	1204.74	2411.72	1600.26	11	9	18
Total	990	1327.681	514.415	2796.656	638.799	2694.886	678.261	195	103	692

1. <http://dlgfir.com/pre-negotiated-chapter-11-plans/>

Table 1.2: Summary Statistics

The table reports summary statistics of the main variables used in the analysis. Panel A shows the descriptive statistics of bankruptcy-related CEOs only. Panel B shows the summary statistics for all other executives in ExecuComp database. Panel C reports the summary statistics of control variables. All the variables are lagged by one year - except *Outsider CEO*. *MA Score* is the managerial ability score developed Demerjian, Lev and McVay (2012).

Panel A: Summary Statistics of bankruptcy-related CEOs						
Variables	N	Mean	SD	Q1	Median	Q3
MA Score	383	-0.075	0.108	-0.137	-0.092	-0.0231
Total Compensation (In Thousands)	408	3809.15	6424.89	805.774	1718.87	4451.32
Human Capital	408	38.744	5.534	34.330	38.461	42.797
CEO Tenure (Year)	990	6.058	6.534	1.559	3.586	8.296
Age	408	54	8	49	54.5	60
CEO Duality	404	0.589	0.493	0	1	1
Outsider CEO	402	0.378	0.514	0	1	1
Cash Compensation (In Thousands)	408	1149.75	1789.96	404.104	633.349	1092.53
Proportion of Cash pay	408	0.891	0.234	1	1	1
CEO Common Stock value (In Thousands)	167	27441.98	164663.05	305.233	1146.76	5391.99
CEO Option Value (In Thousands)	110	2277.22	6926.2	0	467.272	2272.94

Panel B: Descriptive Statistics for NON-bankruptcy related CEOs in ExecuComp Database						
Variables	N	Mean	SD	Q1	Median	Q3
Ma Score	30526	0.012	0.145	-0.077	-0.022	0.061
Total Compensation (In Thousands)	30856	4905.08	9547.06	1228.20	2679.92	5749.26
Human Capital	30751	40.056	5.811	36.532	40.172	43.724
CEO Tenure (Year)	31009	6.776	7.327	2	5	9
Age	31009	55.314	7.508	50	55	60
CEO Duality	31074	0.324	0.468	0	0	1
Outsider CEO	33798	0.159	0.366	0	0	0
Cash Compensation (In Thousands)	16660	1674.3	2431.45	596.086	1030.5	1880.84
Proportion of Cash pay	16468	0.615	0.313	0.361	0.6	0.927
CEO Common Stock value (In Thousands)	29356	136567.13	3071157.7	1794.42	6535.38	22737.45
CEO Option Value (In Thousands)	16500	2269.11	9206.08	0	583.331	1937.14

Panel D: Summary statistics of all other control variables						
Variables	N	Mean	SD	Q1	Median	Q3
Investment	28045	0.293	0.391	0.132	0.211	0.343
Cash Flow	27922	0.799	16.175	0.186	0.421	0.889
Leverage	30580	0.331	0.964	0.07	0.302	0.479
Cash Holding	27943	2.761	21.387	0.098	0.424	1.632
Dividend Earning	30636	0.087	0.708	0	0.008	0.118
Advertise	28055	0.016	0.048	0	0	0.01
SG&A	30677	0.247	0.475	0.101	0.206	0.332
Entrenchment Index	5205	2.433	1.282	2	2	3
Governance Index	6151	9.273	2.668	7	9	11

Table 1.3: Correlation matrix

	Bankruptcy Dummy	MA Score	Tenure	CEO Duality	Outsider Dummy	Investment	Cash flow	Leverage	Cash Holding	Dividend /Earning	Advertise	SG&A	Entrench.
MA Score	-0.0335***	1											
Tenure	-0.0297***	0.0189***	1										
CEO Duality	0.0016	0.0360***	0.1511***	1									
Outsider Dummy	0.00711	0.0251***	0.1292***	0.0759***	1								
Investment	-0.0184***	0.1706***	0.0318***	-0.0131**	0.0603***	1							
Cash flow	-0.0065	0.0680***	0.0012	-0.0067	-0.0112*	0.0110*	1						
Leverage	0.0345***	-0.0355***	-0.0291***	0.0137**	-0.0350***	-0.0445***	0.0071	1					
Cash Holding	-0.0075	0.1273***	0.0106**	-0.0356***	0.0160***	0.1599***	0.7969***	-0.0034	1				
Dividend/Earning	-0.0009	0.0029	-0.0038	0.0048	-0.0213***	-0.0289***	0.0031	0.0025	-0.0032	1			
Advertise	0.0011	0.1264	-0.0157**	0.0101*	-0.0012	0.0985***	0.0064	-0.0022	0.0144**	-0.0006	1		
SG&A	-0.0063	0.1106***	-0.0094	-0.0213***	0.0518***	0.0662***	-0.0161***	-0.0325***	0.04903***	-0.0114**	0.0769***	1	
Entrenchment	0.0063	-0.1432***	-0.1011***	0.0205	-0.0934***	-0.1268***	-0.0534***	0.0406***	-0.0824***	0.0026	-0.0390***	-0.0850***	1
Governance	-0.0016	-0.0596***	-0.1143***	0.0965***	-0.0833***	-0.1741***	-0.0732***	0.0773***	-0.0925***	0.0465***	-0.0426***	-0.1190***	0.7339***

Table 1.6: Managerial ability, based on CEO Human capital, and bankruptcy – Full Sample

The table reports regression results of CEO ability, measured by the CEO human capital component of organizational capital, on bankruptcy. The table shows how managerial ability affects corporate bankruptcy using an alternative measure of managerial fixed effects as derived by Yildirim and Allen (2017). The dependent variable is a dummy variable that takes a value of one in the event of bankruptcy, and zero otherwise. Column (1) shows the effects of managers' human capital on bankruptcy based on the full sample of CEOs. Column (2) presents the regression results by adding three different CEO characteristics. Column (3) includes the effect of *entrenchment index* developed by Bebchuk *et al.* (2008). Column (4) presents the results of the impact of *governance index* developed by Gompers *et al.* (2003). In column (5) the effects of the interaction between human capital and firm leverage is shown. Column (6) shows the effects of the interaction between firm leverage and entrenchment index. Column (7) shows the effects of the interaction between firm leverage and governance index. All variables are lagged by one year except *Outsider Dummy*. Included but not reported are Year effects, Fama and French 48 industry dummies, and the regression constant term. T-values are in parenthesis. ***, **, and * denote significant at 1%, 5%, and 10% level, respectively. All the variables are defined in Appendix A.

Variables	DV: Bankruptcy Dummy =1						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Human Capital	-0.0168*** (-15.12)	-0.0197*** (-16.38)	-0.0384*** (-6.86)	-0.0351*** (-6.82)	-0.0171*** (-9.99)	-0.0191 (-0.49)	0.0163 (0.10)
Investment	-0.4297*** (-8.26)	-0.4140** (-6.56)	-0.7630** (-3.61)	-0.7720** (-4.02)	-0.4116** (-6.44)	-0.7534* (-3.51)	-0.7695** (-4.02)
Cash Flow	-0.0325*** (-20.05)	-0.0297*** (-15.20)	0.1132 (0.57)	0.0814 (0.37)	-0.0294*** (-14.80)	0.1029 (0.49)	0.0728 (0.29)
Leverage	0.0741*** (15.94)	0.0658*** (13.25)	0.8450*** (13.03)	0.6792*** (14.00)	0.4472* (2.76)	0.8914*** (13.71)	0.7141*** (14.47)
Cash Holding	-0.0359** (-3.88)	-0.0330* (-2.97)	-0.1612 (-2.02)	-0.1261 (-1.48)	-0.0327* (-2.92)	-0.1362 (-1.49)	-0.1123 (-1.21)
Dividend Earning	-0.0054 (-0.02)	0.0079 (0.03)	-0.2478 (0.54)	-0.2449 (-0.50)	0.0088 (0.03)	-0.2368 (-0.49)	-0.2305 (-0.44)
Advertisement	0.5203 (0.41)	0.4659 (0.34)	0.5549 (0.05)	-0.1925 (-0.01)	0.4865 (0.36)	0.4677 (0.03)	-0.1255 (0.00)
SG&A	0.0051 (0.03)	0.0006 (0.00)	0.1523 (0.05)	0.1215 (0.03)	0.0008 (0.00)	0.1456 (0.04)	0.1018 (0.02)
Tenure		-0.1339*** (-17.46)	-0.1959** (-4.96)	-0.2150*** (-6.71)	-0.1324*** (-16.97)	-0.1979** (-5.09)	-0.2168*** (-6.86)
Outsider CEO		0.0094 (0.01)	-0.0104 (0.00)	0.0120 (0.00)	0.0105 (0.02)	-0.0038 (0.00)	0.0230 (0.01)
CEO Duality		0.1574 (2.53)	-0.0191 (-0.01)	-0.0366 (-0.02)	0.1555 (2.46)	-0.0355 (-0.02)	-0.0280 (-0.01)
Entrenchment Index			0.0755 (1.02)			0.6170 (1.04)	
Governance Index				-0.0182 (-0.31)			0.2639 (0.92)
Human Capital*Leverage					-0.0076 (-1.93)		
Leverage*Entrenchment						-0.0106 (-0.77)	
Leverage*Governance							-0.0065 (-1.10)
No. of Observations	27537	23999	4037	4780	23999	4037	4780
Max-rescaled R-Square	0.1317	0.1494	0.3333	0.3212	0.1508	0.3355	0.3241
Industry FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y

Table 1.7: Managerial ability and Median Compensation Change of Incumbent CEOs and departing CEOs – either as CEOs of reorganized companies or as CEOs of outside companies during post-bankruptcy career

This table reports regression results of incumbent CEO ability, measured by the MA Score, on the median compensation change of incumbent CEOs who file for Chapter 11 and continue as CEOs during post-bankruptcy career. The sample consists of both group of CEOs who continue at the helm of the restructured firm and leaves over the bankruptcy event period. Columns (1) and (2) report the effects of MA Score on the percent change in compensation (in thousands of dollars) three years before the filing of bankruptcy to three years after they started working as CEOs of the reorganized firms, or as CEOs of outside firms. Compensation change is the difference between the old compensation and new compensation of the incumbent CEOs. Columns (3) and (4) report the effects of MA Score on the present value (PV) of compensation change. PV of compensation change is the present value of the compensation change through age 65, discounted at a 10% rate, and adjusted for severance pay and time of joining new employment. The main independent variable of interest is the *managerial ability score* developed by Demerjian *et al.* (2012). *CEO Age* is the natural logarithm of the age of CEOs. *Prior CEO* is a dummy variable that takes a value of 1 if CEOs have prior experience as CEOs before serving as the CEOs of bankrupt companies, and zero otherwise. *CEO Duality* is a dummy variable that takes a value of one if a CEO serves also as a chairman, and zero otherwise. *CEO After Bankruptcy* is a dummy variable that takes a value of 1 if the bankruptcy filing CEOs either remains CEOs of the restructured firms or become CEOs of other firms, and zero otherwise. *Incumbent* is a dummy variable that takes a value of 1 if the CEO in charge of the firm at the fiscal year-end three years prior to bankruptcy filing (event year – 3), and zero otherwise. *Founder Incumbent* is a dummy variable that takes a value of 1 if the incumbents are also company founders, and zero otherwise. *Bond debt* is a dummy variable that takes a value of 1 if the company has bonds outstanding prior to bankruptcy filing, and zero otherwise. *Size* is the natural logarithm of total assets. *Prepack* is a dummy variable indicating that a reorganization plan is filed jointly with the bankruptcy petition. *DIP Loan* is a dummy variable indicating that the firm receives debtor-in-possession (DIP) financing. *Industry Distress* is a dummy variable that takes a value of one if the median stock return in the two-digit SIC code is less than –30% in that year, and zero otherwise. Included but not reported are Year effects, Fama and French 12 industry dummies, and the regression constant term. T-values are in parenthesis. ***, **, and * denote significant at 1%, 5%, and 10% level, respectively.

Variables	Percent Change in Compensation 3-yrs before filing to 3-yrs after reorganizations for Incumbent CEOs and departing CEOs to another firm		Present Value of Compensation change 3-yrs before filing to 3-yrs after for Incumbent CEOs and departing CEOs to another firm	
	(1)	(2)	(3)	(4)
MA Score	3.5520* (1.94)	3.6151* (1.95)	1.9879** (2.05)	1.9844** (2.04)
CEO Age	-0.1229 (-0.10)	-0.1975 (-0.16)	-0.3947 (-0.63)	-0.3821 (-0.61)
Prior CEO	-0.0841 (-0.20)	-0.0368 (-0.09)	-0.3330* (-1.89)	-0.3382* (-1.85)
CEO Duality	-0.9327*** (-2.72)	-0.8653** (-2.50)	-0.3228* (-1.67)	-0.3329* (-1.67)
CEO after Bankruptcy	1.2818*** (4.11)	1.2508*** (4.02)	1.0029*** (5.61)	1.0068*** (5.57)
Founder Incumbent		-0.4914 (-1.43)		0.0726 (0.29)
Bond Debt	0.3713 (0.65)	0.3728 (0.64)	0.4466 (0.92)	0.4575 (0.92)
Size	0.2105 (1.40)	0.2005 (1.35)	-0.0898 (-0.93)	-0.089 (-0.92)
Prepack	1.3809*** (2.64)	1.3517** (2.60)	0.3067 (1.55)	0.309 (1.55)
Dip Loan	0.5666 (1.35)	0.5533 (1.33)	0.2853 (1.32)	0.2839 (1.31)
Industry Distress	-0.2160 (-0.44)	-0.3132 (-0.63)	-0.1376 (-0.46)	-0.1242 (-0.42)
R ²	0.4160	0.4192	0.4407	0.441
No. of Observation	178	178	167	167
Industry FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y

Tables 1.8: Managerial ability and years until incumbent CEOs continue in the office after filing for Chapter 11

Columns (1) and (2) report how managerial ability affects the tenure of incumbent CEO in the bankrupt company from the date a company files for bankruptcy to the date the filing CEO continues in the office. The main independent variable of interest is the *managerial ability score* (MA Score) developed by Demerjian *et al.* (2012). *Founder Incumbent* is a dummy variable that takes a value of 1 if the incumbents are also company founders, and zero otherwise. *CEO Age* is the natural logarithm of the age of CEOs. *Prior CEO* is a dummy variable that takes a value of 1 if CEOs have prior experience as CEOs before serving as the CEOs of bankrupt companies, and zero otherwise. *CEO Duality* is a dummy variable that takes a value of one if a CEO serves also as a chairman, and zero otherwise. *Bond debt* is a dummy variable that takes a value of 1 if the company has bonds outstanding prior to bankruptcy filing, and zero otherwise. *Firm size* is the natural logarithm of total assets. *Prepack* is a dummy variable indicating that a reorganization plan is filed jointly with the bankruptcy petition. *DIP Loan* is a dummy variable indicating that the firm receives debtor-in-possession (DIP) financing. *Industry Distress* is a dummy variable that takes a value of one if the median stock return in the two-digit SIC code is less than -30% in that year, and zero otherwise. Included but not reported is the regression constant term. T-values are in parenthesis. ***, **, and * denote significant at 1%, 5%, and 10% level, respectively.

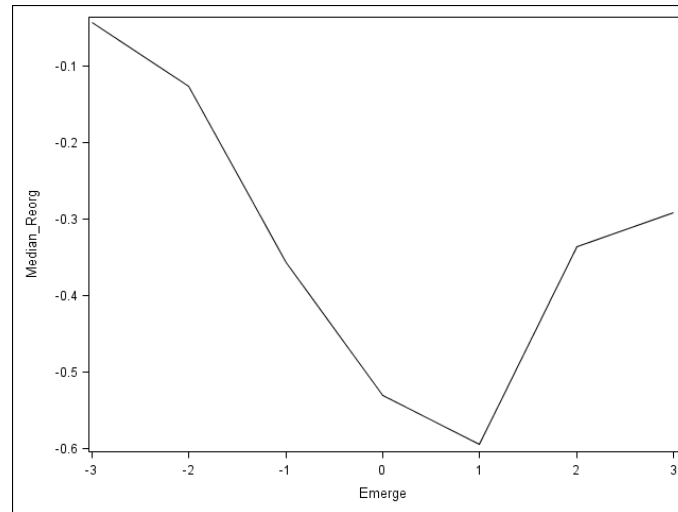
DV = Number of years bankruptcy-related CEOs continue as CEOs of the filing companies		
Variables	(1)	(2)
MA Score	3.5836* (1.89)	4.0610* (1.80)
Founder Incumbent		0.4858 (1.5081)
CEO Age	-8.6911** (-2.31)	-8.5808** (-2.32)
Prior CEO	1.3184 (1.13)	1.2422 (1.15)
CEO Duality	1.9352 (1.23)	1.8217 (1.66)
Bond Debt	3.8155** (2.23)	3.8746** (2.16)
Size	-1.8136 (-1.39)	-1.7679 (-1.44)
Prepack	-1.1467 (-1.03)	-1.1011 (-0.96)
Dip Loan	-0.4915 (-0.49)	-0.3955 (-0.39)
Industry Distress	0.2532 (0.28)	0.3085 (0.34)
R ²	0.2426	0.2510
No. of Observation	55	55
Industry FE	N	N
Year FE	N	N

Table 1.9: managerial ability & Industry-Adjusted ROA during post-bankruptcy employment of bankruptcy-related incumbent CEOs – as CEOs of the reorganized companies as well as outside companies

The table examines how managerial ability affects Industry-Adj. ROA of those companies where Chapter 11 related incumbent CEOs continue their career as CEOs during post-bankruptcy employment. The main independent variable of interest is the *managerial ability score* (MA Score) developed by Demerjian *et al.* (2012) of incumbent CEOs in the year of bankruptcy filing. Column (1) reports the impact of MA ability of all the CEOs who continue their career as CEOs during post chapter 11 period – either in the same company or in a different company. Column (2) reports the impact of MA score only for those CEOs who are *founder incumbents* in the bankrupt company and continue their career as CEOs during post-chapter 11 period. Finally, column (3) and column (4) reports the effects of MA Score for those CEOs who continue their career as CEOs of reorganized companies. The main independent variable of interest is the *managerial ability score* developed by Demerjian *et al.* (2012). *CEO Age* is the natural logarithm of the age of CEOs. *Prior CEO* is a dummy variable that takes a value of 1 if CEOs have prior experience as CEOs before serving as the CEOs of bankrupt companies, and zero otherwise. *CEO Duality* is a dummy variable that takes a value of one if a CEO serves also as a chairman, and zero otherwise. *Bond debt* is a dummy variable that takes a value of 1 if the company has bonds outstanding prior to bankruptcy filing, and zero otherwise. *Firm size* is the natural logarithm of total assets. *Prepack* is a dummy variable indicating that a reorganization plan is filed jointly with the bankruptcy petition. *DIP Loan* is a dummy variable indicating that the firm receives debtor-in-possession (DIP) financing. *Industry Distress* is a dummy variable that takes a value of one if the median stock return in the two-digit SIC code is less than -30% in that year, and zero otherwise. Included but not reported is the regression constant term. T-values are in parenthesis. ***, **, and * denote significant at 1%, 5%, and 10% level, respectively.

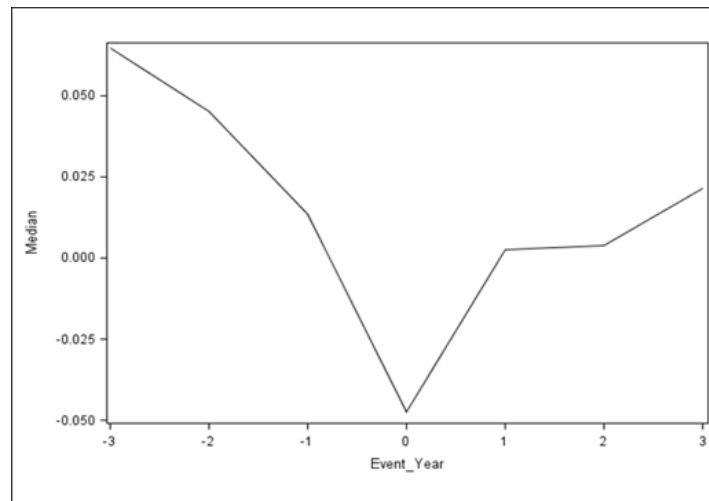
Variables	DV = Industry Adj. ROA					
	All Incumbents (Reorganized and Outside companies)		Incumbents Continuing as CEOs of Reorganized Companies		Incumbents Continuing as CEOs of Outside Companies	
	(1)	(2)	(3)	(4)	(5)	(6)
MA Score	3.3141*** (8.93)	3.2980*** (8.78)	3.4256*** (8.18)	3.4448*** (8.02)	1.2992** (3.17)	1.3016* (2.79)
Founder Incumbent		0.1207 (0.43)		-0.1124 (-0.26)		-0.0337 (-0.28)
CEO Age	0.6186 (1.21)	0.6341 (1.23)	0.6822 (1.15)	0.6617 (1.10)	0.2063 (0.66)	0.2665 (0.64)
Prior CEO	0.1008 (0.81)	0.0815 (0.61)	0.0225 (0.15)	0.0333 (0.21)	0.3000** (3.96)	0.3182* (2.95)
CEO Duality	0.0253 (0.20)	0.0227 (0.18)	0.0741 (0.49)	0.0789 (0.52)	-0.2327** (-3.84)	-0.2424* (-3.13)
Bond Debt	0.3323 (1.12)	0.3409 (1.13)	0.3094 (0.95)	0.3053 (0.93)	0.4193*** (7.66)	0.4226*** (6.66)
Size	0.1931* (1.67)	0.2027* (1.71)	0.1522 (1.10)	0.1420 (0.98)	0.5851*** (9.13)	0.5789*** (7.58)
Prepack	0.5825*** (4.27)	0.5928*** (4.25)	0.5841*** (3.53)	0.5773*** (3.41)	0.4476*** (-6.06)	0.4493** (-5.32)
Dip Loan	-0.1226 (-0.80)	-0.1210 (0.79)	-0.0415 (-0.23)	-0.0448 (-0.24)	-0.2958* (-2.28)	-0.32454 (-1.81)
Industry Distress	0.2308 (1.49)	0.2443 (1.53)	0.2352 (1.33)	0.2259 (1.24)	1.2992** (3.17)	1.3016* (2.79)
R ²	0.6629	0.664	0.6757	0.6762	0.9856	0.9860
No. of Observation	71	71	58	58	13	13
Industry FE	N	N	N	N	N	N
Year FE	N	N	N	N	N	N

Figure 1.1



The figure shows the median industry adj. ROA of reorganized companies who continue with chapter 11 related incumbent CEOs. *Emerge = 0* represents the year in which a bankrupt company emerges from Chapter 11. The figure presents the time frame over a period of six years – from three years before the hiring to three years after the hiring. *Median_Reorg* represents the median Industry-adj. ROA of reorganized companies. (58 CEOs)

Figure 1.2



Panel B: The figure shows the median industry adj. ROA of outside (non-chapter 11) companies who hired the chapter 11 related incumbent CEOs. *Event_Year = 0* represents the year in which a chapter 11 related incumbent CEO has been hired by an outsider company. The figure presents the time frame over a period of six years – from three years before the hiring to three years after the hiring. *Median* represents the median Industry-adjusted ROA. (13 CEOs)

Table 1.10: Effects of Institutional holding in the bankrupt firm on CEO compensation during post-bankruptcy employment as CEOs.

The table reports regression results of change in CEO compensation after Chapter 11 reorganization for Incumbent CEOs and departing CEOs to another firm on institutional investor holdings. Columns (1) and (2) report how institutional holdings affect the percent change in compensation (in thousands of dollars) from three years before the filing of bankruptcy to three years after starting to work as CEO of the reorganized firm, or as CEO of a new firm – for *all incumbent CEOs*. Compensation change is the difference between the old compensation and new compensation institutional. Columns (3) and (4) report how institutional holdings affect the present value (PV) of compensation change of *all CEOs*. PV of compensation change is the present value of the compensation change through age 65, discounted at a 10% rate, and adjusted for severance pay and time of joining new employment (in thousands of dollars). The main independent variable of interest is the *managerial ability score* developed by Demerjian *et al.* (2012). *CEO Age* is the natural logarithm of the age of CEOs. *Prior CEO* is a dummy variable that takes a value of 1 if CEOs have prior experience as CEOs before serving as the CEOs of bankrupt companies, and zero otherwise. *CEO Duality* is a dummy variable that takes a value of one if a CEO serves also as a chairman, and zero otherwise. *CEO After Bankruptcy* is a dummy variable that takes a value of 1 if the CEO remains CEO of the restructured firm or becomes CEO of other firms, and zero otherwise. *Founder Incumbent* is a dummy variable that takes a value of 1 if the incumbents are also company founders, and zero otherwise. *Institutional Holding* represents the percentage of shares held by institutional investors in the bankrupt companies in the year of bankruptcy filing. *Firm size* is the natural logarithm of total assets. *Bond debt* is a dummy variable that takes a value of 1 if the company has bonds outstanding prior to bankruptcy filing, and zero otherwise. *DIP Loan* is a dummy variable indicating that the firm receives debtor-in-possession (DIP) financing. *Prepack* is a dummy variable indicating that a reorganization plan is filed jointly with the bankruptcy petition. *Industry Distress* is a dummy variable that takes a value of one if the median stock return in the two-digit SIC code is less than -30% in that year, and zero otherwise. Included but not reported is the regression constant term. T-values are in parenthesis. ***, **, and * denote significant at 1%, 5%, and 10% level, respectively.

Variables	Percent Change in Compensation from 3-yrs before filing to 3-yrs after new employment as CEO		Present Value of Compensation change 3-yrs before filing to 3-yrs after new employment as CEO	
	(1)	(2)	(3)	(4)
MA Score	5.5373 (1.66)	5.4652 (1.61)	5.5800** (2.60)	5.5484** (2.69)
CEO Age	-0.9150 (-0.23)	-0.9663 (-0.24)	-1.1080 (-0.64)	-1.1684 (-0.65)
Prior CEO	-1.0677 (-1.38)	-1.1410 (-1.36)	-0.8926** (-2.51)	-0.9556** (-2.48)
CEO Duality	0.9075 (1.60)	0.8308 (1.42)	0.4053 (1.12)	0.3373 (0.89)
CEO After Bankruptcy	0.8273 (0.56)	0.7349 (0.46)	0.3193 (0.70)	0.2198 (0.49)
Founder Incumbent		0.3687 (0.43)		0.3937 (0.93)
Institutional Holding	-0.6479 (-0.36)	-0.5160 (-0.27)	-1.5744* (-1.88)	-1.4232 (-1.62)
Bond Debt Dummy	-1.0308 (-0.84)	-0.9801 (-0.77)	0.3537 (1.12)	0.4037 (1.19)
Size	-0.5629 (-1.15)	-0.5460 (-1.06)	-0.3283* (-1.83)	-0.3211* (-1.89)
prepack	2.0864* (1.80)	2.1590* (1.85)	0.7883*** (2.97)	0.853*** (2.87)
Dip Loan	1.0904 (1.01)	1.1895 (1.08)	-0.0710 (-0.22)	0.0060 (0.02)
Industry Distress	0.4657 (0.31)	0.5024 (0.33)	0.274 (0.36)	0.3143 (0.42)
Institutional Holding*CEO After	0.4065 (0.08)	0.4953 (0.09)	0.4207 (0.29)	0.5579 (0.39)
R ²	0.4061	0.4076	0.651	0.6641
No. of Observation	36	36	33	33
Industry FE	N	N	N	N
Year FE	N	N	N	N

ESSAY 2: CEO RISK PREFERENCES AND CORPORATE BANKRUPTCY

1. Introduction

In this study, we examine whether the risk preferences of chief executive officers (CEOs) are linked to firm bankruptcy since they can affect riskiness of corporate policies. The seminal work of Jensen and Meckling (1976) suggests that risk-aversion (risk-seeking) inducing executive compensation has the ability to influence riskiness of corporate decisions. That is, managers with high (low) debt wage contracts (inside debt) have incentive to engage in less (more) risky decisions. Research on the effects of CEO compensation also concludes that compensation structure has profound impact on firms' operational, financial and investment policies (Coles, Daniel & Naveen 2006; Cassell, Huang, Sanchez & Stuart 2012; Caliskan & Doukas 2015). However, scant scholarly attention has been given to the potential influence of CEO risk preference inducing compensation structure on firm bankruptcy. This is possible for several reasons. One likely possibility is that since cash compensation is less sensitive to poor earnings performance (Shaw & Zhang 2010), CEOs with higher percentage of cash compensation may make imprudent investment decisions involving poor firm performance and the associated destruction of firm value. Further, extensive use of equity-based compensation in the form of stock and option awards can increase the sensitivity of CEO wealth with respect to firms' stock return volatility (i.e., through convex compensation contracts) (Jensen & Murphy 1990b; Hall & Liebman 1998). Since firms that experience highly volatile stock returns in the past are more likely to end up in bankruptcy (Campbell, Hilscher & Szilagyi 2008), we expect CEOs with equity-based compensation to be associated with bankruptcy. Further, since stock options granted at the money are less affected by downside risk than stock awards, a higher proportion of stock options in comparison to stock awards protects CEOs from downside risk by introducing convexity (De Angelis, Grullon &

Michenaud 2013). Thus, granting stock options protects CEOs from downside risk as a result of which they engage in risky projects that might eventually fail (Haugen & Senbet 1981). This also suggests equity compensation that is sensitive to stock return volatility (i.e., high vega) induces CEOs to select projects that may eventually lead to firm bankruptcy.

On the other hand, high CEO delta (i.e., CEO compensation that is sensitive to stock price changes) is known to lead to more conservative policies (Core & Guay 2002). Specifically, CEOs with high delta tend to hedge more (Knopf, Nam & Thornton Jr 2002) and decrease R&D and leverage (Coles *et al.* 2006). Therefore, risk-reducing CEO compensation structure may reduce probability of firm bankruptcy. Similarly, since the presence of inside debt in compensation exposes CEOs to default risk similar to creditors and unfunded liabilities of firms, for bankrupt firms, CEO inside debt holdings in the firms are also at risk (Sundaram & Yermack 2007; Edmans & Liu 2010). Therefore, high-inside debt in CEO compensation (i.e., linear compensation) is more likely to be associated with lower probability of firm bankruptcy. Hence the question we address in this study is whether risk-seeking CEOs are more likely to be associated with bankruptcy. To put it differently, we aim to find out whether risk-seeking (risk-averse) inducing CEO compensation exacerbates (mitigates) firm bankruptcy.

In this paper, we aim to shed light on this issue by focusing on different components of CEO compensation. Specifically, we focus on three different compensation components – vega (sensitivity of CEOs' wealth to stock return volatility), delta (sensitivity of CEOs' wealth to stock price), and inside debt (pension and deferred compensation) to examine whether convex (linear) compensation structures are more (less) likely to be linked with probability of bankruptcy.

Because CEO compensation data are available since 1992 and inside debt data are available since 2006, we test our hypothesis based on two different samples – from 1992 through 2016 to

test the relation between convex compensation structure and probability of bankruptcy, and from 2006 through 2016 to test the role of CEO inside debt on probability of bankruptcy. We use logistic regressions to estimate the effects of CEO risk preference on probability of bankruptcy. Our evidence lends support to our hypothesis. Specifically, we find that CEOs with high inside debt and high delta (i.e., CEOs with low risk tolerance) are less likely to be associated with bankruptcy, whereas CEOs with high vega (i.e., CEOs with high risk tolerance) are more likely to be associated with firm bankruptcy.

Our findings are robust to a battery of additional tests. First, we examine whether the relation between inside debt and probability of bankruptcy is non-linear. If the relation between these two is non-linear, then CEOs with high inside-debt may be associated with lower probability of bankruptcy and CEOs with low inside-inside debt may be associated with higher probability of bankruptcy. To check this possibility, we use a dummy variable that captures high and low level of inside debt, measured through CEO relative leverage. Our evidence shows that when CEO personal wealth can be expressed in terms of firm leverage, CEOs with high inside debt are less likely to be associated with probability of bankruptcy, irrespective of other compensation components and firm characteristics.

In the second robustness test, we check whether the decision to focus on a small number of businesses or diversify across different lines has a bearing on probability of bankruptcy. In terms of firm focus, there is evidence that narrowly focused firms perform better than widely focused firms (Wernerfelt & Montgomery 1988). However, Singhal and Zhu (2013) find that diversification reduces probability of bankruptcy. Further Coles *et al.* (2006) show that high CEO vega increases firm focus while low CEO delta decreases firm focus. Hence, considering the nature of CEO compensation conditional on firm focus, we expect a weaker positive association between

CEO vega and probability of bankruptcy, and a stronger negative association between CEO delta and probability of bankruptcy. Complementing the finding of Singhal and Zhu (2013), our analyses show that when we account for firm diversification, the positive impact of vega on bankruptcy reduces, while the negative impact of delta increases.

In our third and final robustness test, we examine the combined effect of CEO risk preference inducing compensation and firm leverage. This is because firms decrease their leverage when CEO compensation includes more options (Tosun 2016) and bondholders require higher interest on their lending as CEOs with high option incentives are more likely to increase stock price volatility by investing in risky projects (Agrawal & Mandelker 1987; DeFusco, Johnson & Zorn 1990). Therefore, by considering the combined effects of various compensation components and firm leverage, we examine whether the negative impact of firm focus on bankruptcy persists. Our results indicate that firm focus is still negatively associated with bankruptcy. However, the negative effect is less pronounced in firms run by CEOs with convex compensation (high-vega).

In sum, testing the link between CEO risk preference and bankruptcy probability, we find that risk-averse CEOs are less likely to be associated with bankruptcy than risk-seeking CEOs. In other words, CEOs may seek risky investment opportunities as the presence of option-based compensation increases risk-seeking behavior. Complementing the findings of previous literature, we show that the presence of risk-reducing initiatives, such as firm diversification (expressed in terms of number of segments) weaken the positive effect of CEO vega and strengthens the negative effect of CEO delta on bankruptcy.

The rest of the study is organized as follows. The next section presents a literature review on the antecedents and consequences of CEO compensation structure on difference aspects of firms' investment and financial policies. Section 2 develops a testable hypothesis and discusses

the probable impact of CEO risk preference on firm bankruptcy. Section 3 presents the results of our empirical analysis and robustness checks. Section 4 concludes the paper.

2. Literature review and hypothesis development

2.1. CEO cash compensation: salaries and bonuses

Our aim is to find out whether structure of CEO compensation contracts designed to induce CEO risk-seeking behavior increases probability of bankruptcy. Jensen and Murphy (1990a) argue that CEO compensation level is less important than compensation structure and that compensation level is unrelated to firm performance. Consistent with this argument, a wide range of scholarly research has identified how different components of compensation affect different aspects of a firm. For instance, Ozkan (2011) find that cash compensation has a positive and significant relation with firm financial performance, while total compensation has a positive and statistically insignificant relation with firm performance. However, Shaw and Zhang (2010) find that CEO cash compensation is less sensitive to poor earnings performance than to better earning performance. This may indicate that a higher proportion of cash compensation may induce CEOs to be reckless and imprudent in making firm-related decisions. This may also suggest that cash compensation may have a positive relation with bankruptcy as such compensation may induce CEOs to focus more on short-term benefits rather than increasing the long-term value of their firms.

2.2 CEO equity compensation

Jensen and Meckling (1976) argue that the nature of a firm's business – such as business risk, nature of assets, cash flow, size, etc. – influences firms' ownership structure, executive compensation, and board composition. They suggest that since these factors also influence firm performance – which directly benefits equity-holders – equity-holders can induce CEOs to take on

risky projects by way of establishing incentive-based compensation as well as by granting stock options. However, the extent of benefits CEOs can extract from this type of incentive-based compensation or stock options is uncertain as the fate of a project depends not only on idiosyncratic factors but also on systematic factors. Therefore, to protect themselves from such uncertainty, CEOs prefer compensation structures that reduce their personal risk of wealth loss, and they prefer more cash-based compensation over equity-based compensation (Harris & Raviv 1979). Further, when CEOs are granted equity-based compensation, to reduce the associated risk of such compensation they may be engaged in risk-reducing activities which may adversely affect shareholder wealth (Jensen & Meckling 1976; Amihud & Lev 1981). Smith and Stulz (1985) show that when managers' wealth is associated with firm performance, CEOs may become risk-averse and stay away from risky positive NPV projects, because of low variability of CEO compensation in comparison to the changes in shareholders' wealth (Jensen & Murphy 1990b). Therefore, in line with Lambert, Larcker and Verrecchia (1991) we also argue that when CEO compensation structure consists of large proportion of equity compensation, they are more likely to be risk-averse, and as a result equity-based compensation may be associated with lower probability of bankruptcy.

2.3 CEO delta and vega

However, the effect of CEOs' equity-based compensation on the riskiness of corporate policies depends not only on the size of such compensation, but also on its sensitivity to stock price (delta) and stock return volatility (vega) (Guay 1999; Core & Guay 2002). Core and Guay find that high delta leads to more conservative policies while high vega is positively associated with risky corporate policies, since it increases the convexity of compensation. For example, Knopf *et al.* (2002) show that CEOs with delta tend to hedge more, Coles *et al.* (2006) show that high delta

induces CEOs to reduce R&D investment and firm leverage and increases capital expenditure and firm diversification. Billett, Mauer and Zhang (2010) show that when CEOs have little or no stock ownership in their firms prior to grants, high delta is positively associated with excess bond return. On the other hand, CEOs with high vega tend to increase R&D investment and firm leverage and decrease capital expenditures and firm diversification (Coles *et al.* 2006; Low 2009; Hagendorff & Vallascas 2011). Therefore, we expect that CEOs with high vega (delta) are more (less) likely to be associated with risky (less risky) policy choices and high (low) probability of bankruptcy.

2.4 CEO inside debt

Since CEO inside debt has the characteristics of unsecured creditors, CEOs with inside debt are more likely to make investment and financing decisions that reduce agency cost of debt (Jensen & Meckling 1976). As debt-holders' return is fixed irrespective of firm performance, they prefer conservative policies (Watts 2003) as opposed to equity-holders who prefer risky investments and financial policies. Edmans and Liu (2010) find that inside debt induces managers to behave like bondholders. Therefore, it can be expected that the presence of inside debt reduces possibility of default as inside debt aligns interests of CEOs with interest of creditors who do not get wealthier with increase in stock prices but face significant losses in the event of bankruptcy. As a result, inside debt encourages CEOs to reduce investments in risky projects such as R&D, investments and firm leverage (Cassell *et al.* 2012). Further, the presence of inside debt is likely to lead to increased firm cash holdings (Liu, Mauer & Zhang 2014) which increases firms' financial strength and protects firms' from "free-fall" bankruptcies – which is the most frequent form of bankruptcy filing (Chapter 11). Inside debt also induces CEOs to pay dividends to stockholders when these CEOs want to stay away from risky and profitable investments, and at the same time keep shareholders satisfied (Caliskan & Doukas 2015). In line with Caliskan and

Doukas, we argue that in the absence of inside debt, CEOs may invest more in risky new projects which may increase stock return and cash flow volatility, causing market to perceive such firms as riskier and likely candidates of bankruptcy. This may lead to difficulty in raising capital in the event of financial emergencies and may lead to bankruptcy. Since risk averse CEOs are less likely to bear such risk, we argue that CEO inside debt is negatively associated with probability of bankruptcy.

Caliskan and Doukas (2015) also indicate that though the direction in which CEO delta and inside debt influence probability of bankruptcy may be similar, the mechanism through which delta and inside debt influence CEOs' risk-taking behavior may differ significantly. When stock prices go down substantially, the management can take corrective actions to improve firm performance and thus increase stock prices. However, since in the event of bankruptcy, inside debt is mostly uncollectable, it may be expected that CEO inside debt has a stronger negative impact on probability of bankruptcy than CEO delta.

2.5 Firm diversification

Prior research on finance suggests that diversified firms are less likely to face bankruptcy than undiversified firms. For example, Lewellen (1971) shows that in the presence of imperfect capital markets, diversified firms are less likely to go bankrupt. Leland (2007) find that diversification reduces financial distress and diversified firms may have greater value. Diversified firms experience low stock return volatility (Jankensgård & Vilhelmsson 2015) and there is a statistically significant difference in the unsystematic risk between bankrupt and non-bankrupt companies (Aharony, Jones & Swary 1980). Complementing these findings, Shumway (2001) show that firms with high idiosyncratic volatility are more likely to go bankrupt than firms with

low idiosyncratic volatility. Therefore, we are interested to know if the impact of firm diversification along with CEO compensation structure influences probability of bankruptcy.

This study recognizes the fact that bankruptcy cannot be solely attributed to managerial risk-taking behavior. Systematic factors could also play a significant role in determining bankruptcy risk (Lang & Stulz 1992; Denis & Denis 1995). Shumway (1996) supports this finding by showing that default risk is systematic. In sharp contrast, Asquith, Gertner and Scharfstein (1994) and Opler and Titman (1994) show that firm debt structure is responsible for financial distress, which is indicative of idiosyncratic default risk. As noted by Fiordelisi and Marques-Ibanez (2013), the mixed results from previous scholarly work are caused by various indicators used for measuring default risk. For example, Dichev (1998) and Griffin and Lemmon (2002) use accounting methods, Dichev and Piotroski (2001) use bond rating, and Vassalou and Xing (2004) and Campbell *et al.* (2008) use equity market valuation to identify default risk. However, with the exception of few scholarly works that establish a link between compensation structure and bank default risk, such as Houston and James (1995), Vallascas and Hagedorff (2013), and Bennett, Guntay and Unal (2015), there is a lack of scholarly attention on the effect of executive compensation on firm bankruptcy. Therefore, the noble contribution of this study is that it aims to close the gap in literature by investigating whether CEO compensation structures plays a role in bankruptcy. To the best of our knowledge, this is the first study to address this question by focusing on the compensation structure of a large sample of CEOs of those companies that have already filed for bankruptcy.

3. Empirical analysis

3.1. Data and methodology

Our sample consists of bankruptcy filings by US firms during 1992 to 2016 with book value of assets above \$100 million (measured in 2016 dollars) – whether filed by debtors or creditors. We require firms to be publicly traded. Data for bankrupt firms are from the Bankruptcy Research Database (BRD) of Professor Lynn LoPucki at the University of California at Los Angeles (UCLA). We collect CEO compensation data from the Standard & Poor’s Execucomp database, covering firms listed on S&P 500, S&P Midcap 400 and S&P Smallcap 600. We also extensively hand collect data from SEC filing. We use “*CEOANN*” variable in Execucomp to identify the CEOs. To reduce the loss of compensation information, we take the last available compensation data of those CEOs for whom the compensation data is not available in the year prior to bankruptcy. However, we restrict this up to filing year -2. For example, if company X files for Chapter 11 in 2001, we attempt to identify the compensation data for 2000. If the data is not available, then we use compensation data for 1999. By using this method, we identify detailed compensation information for 130 bankruptcy-related CEOs. In cases where Execucomp does not identify an executive as the CEO even though it indicates the dates on which the CEO assumed office and quit office; we classify these executives as CEOs. We exclude those CEOs who had been in office for less than a year.

Since the U.S. Securities and Exchange Commission’s 2006 rule, data on managerial deferred compensation and pension, along with the related information for each stock option tranche (i.e., expiration date, number and exercise price of each option grant), are available in Standard & Poor’s Execucomp database. We calculate CEO inside debt based on the following three measures (Jensen & Meckling 1976; Sundaram & Yermack 2007; Cassell *et al.* 2012). First, we calculate *CEO Inside Debt* as the total dollar value of CEO pension and deferred compensation. Second, we estimate *CEO Relative Leverage* as the ratio of CEO leverage (CEO inside debt

divided by CEO total equity compensation) to firm leverage. We employ the natural logarithm of this measure in our analyses. Finally, we use the dummy variable *High Relative Leverage* which takes a value of one if CEO leverage is higher than firm leverage, and zero otherwise.

Since stock option tranches mature in 10 years, CEOs can have 10 stock option tranches. The detail information on stock option tranches, such as number of stock option, exercise price, and expiration dates are available in Execucomp. Thus, we use detail stock option data following the full information method rather than the one-year approximation method of Core and Guay (2002) for the valuation of stock options. We calculate CEO equity as the dollar value of common stocks, stock options and unvested stocks held by CEO. We estimate the dollar value stock options using the Black-Scholes option pricing model (Black & Scholes 1973). Appendix A provides detailed derivations of these variables.

We calculate CEO delta and vega (sensitivity to stock price and sensitivity to stock option volatility, respectively) following Guay (1999) and Core and Guay (2002) who use Black and Scholes (1973) option valuation model and modify to account for dividends (Merton 1973). CEO delta is defined as the change in a dollar value of CEO's wealth for a 1% change in stock price, and vega is the change in a dollar value of the CEO's wealth for a 0.01 change in the annualized standard deviation of stock returns. Appendix A provides detailed derivations of these variables.

In addition to the above variables, we derive CEO cash compensation as the sum of CEO salary and bonuses. Since cash compensation is associated with short-term motives and does not encourage CEOs to increase the long-term firm performance, cash compensation could be associated with CEOs abusing firm resources and increasing the likelihood of bankruptcy. We also use *CEO Age* (since older CEOs tend to avoid risk (Serfling 2014)), *CEO Duality* – a dummy variable that takes a value of one if a CEO also serves as a chairman of the board of the company

(since dual CEOs are associated with reduced risk-taking propensity (Kim & Buchanan 2008)) and *Outsider CEO* – a dummy variable that takes a value of one if a CEO is hired from outside (since CEOs who are hired from outside are expected to be more risk-taking (Quigley, Hambrick, Misangyi & Rizzi 2019)) as control variables.

We use the Compustat database for firm-specific information and CRSP for stock returns. We calculate the values of control variables following Coles *et al.* (2006). Specifically, we use a) *Capital Exp.* as the ratio of net capital expenditure to assets, b) *R&D* as the research and development expenditure scaled by total assets, c) *Book Leverage* as the ratio of total debt to assets, d) *Market-to-book* as market value of assets to book value of assets – as a proxy for investment opportunities, e) *ROA*, calculated as EBITDA divided by assets, f) *Net PPENT* as net property, plant, and equipment to assets, g) *Size* as logarithm of sales, h) *Surplus Cash* as cash from assets in place to total assets, i) *Dividend Cut*, a dummy variable that takes a value of one if there was a decrease in annual dividend, and zero otherwise. For additional tests, we calculate *Number of Segments* as the number of different businesses in which a firm operates. We lag all variables by one year, except for *Outsider Dummy* variables. A detail description of the variables can be found in Appendix B.

3.2. Descriptive statistics

Table 2.1 reports annual distribution and the characteristics of firm bankruptcy filings. We observe that throughout the 1980s and early 1990s, there is a steady increase in bankruptcy filings, with the number of failed firms reaching a peak during the 2000–2002 period, which coincides with the burst of the dot-com bubble. Again, there is a sharp increase during the 2007–2009 period, caused by the Global Financial Crisis. However, the size of firms that filed for bankruptcy during the 2007–2009 period (ranging from \$5,183.550 to \$29,932.300 million) is much bigger than for

firms filing for bankruptcy during the 2000–2002 period (ranging from \$1,110.930 to \$4,508.340 million).

[Insert Table 2.1 about here]

Table 2.2 Panel A presents the descriptive statistics of all the variables related to firms that filed for bankruptcy from 1992 to 2016. Panel B presents the descriptive statistics for the variables of our interest for non-bankrupt firms. We hypothesize risk-seeking CEOs are more likely to be associated with bankruptcy than risk-averse CEOs. That is, CEOs with high inside debt, high relative leverage, high delta and low vega are expected to be negatively associated with probability of bankruptcy. By comparing Panel A and Panel B, we find that in bankrupt firms, the average CEO cash compensation is higher than the average compensation of the other group, \$1292.18 and 1059.23, respectively. The average inside debt holding of bankruptcy-related CEOs is approximately fifty percent of the inside debt holding of non-bankruptcy related CEOs (\$2172.62 and 4180.81, respectively). This shows that, in general, the low inside debt holdings of bankruptcy related CEOs may be associated with higher probability of bankruptcy. Bankruptcy related CEOs have higher average vega compared to CEOs of non-bankruptcy related firms (\$47.174 compared to \$43.111). In other words, CEO equity compensation is more sensitive to stock return volatility in bankruptcy related firms. Moreover, the average CEO delta in bankruptcy related firms is much lower than the average CEO delta of non-bankruptcy related firms (\$153.534 and \$1355.820, respectively). Therefore, the descriptive statistics appear to be consistent with our hypothesis.

Regarding firm characteristics, the results are consistent with our expectation. The results show that average book leverage of bankrupt firms (0.426) is much higher than the average book leverage of non-bankrupt firms (0.218). Also, bankrupt firms have a low surplus cash (0.058) holding compared to non-bankrupt firms (0.144). In addition, 33.1% of our sample bankrupt firms

reduce the amount of annual dividend prior to filing for bankruptcy, whereas only 13.3% of non-bankrupt firms reduce dividend. Bankrupt firms spend significantly less amount in their R&D (0.005) compared to non-bankrupt firms (0.028). Sueyoshi and Goto (2009) find that R&D expenditure positively influences financial performance. Therefore, we conclude that firms that spend less on the R&D are more likely to face bankruptcy.

In Panel C and Panel D, we compare the related variables during 1992 – 2005 and 2006 – 2016, respectively, because inside debt data are available since 2006. We find that the descriptive statistics are consistent with our main hypothesis. Specifically, bankruptcy-related CEOs receive higher level of average cash compensation compared to non-bankrupt CEOs. Also, the equity compensation of bankruptcy-related CEOs exhibits higher sensitivity to stock return volatility (vega) compared to non-bankruptcy related CEOs, and a lower sensitivity to stock price changes (delta).

In Panel E, we present the t-values of the t-test for the differences in sample means of the variables of our interest related to bankrupt and non-bankrupt companies. The results of our t-tests indicate that the differences between the means of the variables related to these two groups of CEOs are mostly statistically significant. In sum, the results show that most of the variables – both compensation-related and firm-related – are statistically and significantly different.

[Insert Table 2.2 about here]

Table 2.3 presents the correlation coefficients of the main variables of interest. In accord with our previous discussion, we expect inside debt, CEO relative leverage, the delta/vega ratio to be negatively correlated with probability of bankruptcy, as we hypothesize risk-average CEOs are less likely be associated with bankruptcy. CEO cash compensation and vega are positively correlated with probability of bankruptcy at the 1% level, whereas inside debt, equity-holding and

delta are negatively correlated with probability of bankruptcy at 5% level. Regarding firm level variables, book leverage, firm size and dividend cut dummy are positively correlated, whereas all the remaining firm level variables are negatively correlated with probability of bankruptcy. The correlation coefficient of CEO age indicate that older CEOs are less likely to be associated with bankruptcy which is consistent with the previous literature that older CEOs are less risk taking than younger CEOs in their choice of corporate policies (Serfling 2014).

[Insert Table 2.3 about here]

3.3. Logistic regression analysis: the effect of CEO risk tolerance on probability of bankruptcy

The empirical goal of this study is to examine the effect of CEO risk preferences – proxied by CEO inside debt, delta, vega) on probability of bankruptcy. The findings in prior literature suggest that the presence of inside debt and delta induces managers to adopt low risk corporate policies, whereas cash compensation and high vega encourage managers to prefer high risk (i.e., gambles) policies. Since we consider bankruptcy filing as a direct function of CEO risk seeking behavior, we expect CEOs with high vega to be more likely associated with bankruptcy. To test our hypothesis, we run logistic regression in which the dependent variable equals one if a firm goes bankruptcy in year t , and zero otherwise.

Table 2.4 presents the results of the logistics regressions. In the first seven models, we examine the individual effect of CEO risk preference inducing compensation variables separately. For our robustness analyses, we follow previous literature to proxy for inside debt using three variables – a) sum of deferred compensation and pension, b) CEO relative leverage, c) a dummy variable that takes a value of one when CEO leverage is higher than firm leverage. In models (8) through (10), we estimate probability of bankruptcy using all the CEO compensation variables, including the different proxies for inside debt. We estimate all the models using CEO and firm

level control variables, as well as with industry and year dummies. All the coefficients presented are probabilities that are calculated from log odd ratios using natural exponent functions, i.e., e^c where e is the mathematical constant (2.71828) and c is any log odd ratio estimated using the logistic regressions. Hence, the effects of one-unit change in any coefficient on probability of bankruptcy is calculated as follows: $(e^c - 1) * 100$.

The first model shows that CEO cash compensation is positively and significantly associated with bankruptcy. In model (2) through (4), we find that though all three proxies of inside debt are negatively associated with bankruptcy, the relationship is statistically significant at 1% level only when we proxy for inside debt as the sum of deferred compensation and pension, supporting our hypothesis that inside debt is negatively associated with probability of bankruptcy. In economic terms, a \$1 million dollar increase in inside debt would reduce probability of bankruptcy by 29.2%. When we substitute inside debt with CEO relative leverage dummy, we find similar result.

Analyzing the effect of equity compensation and convexity of equity compensation on probability of bankruptcy, we find more supporting evidence for our hypothesis in model (5) through (7). The results in model (5) shows that a one-point increase in CEO delta/vega ratio increases probability of bankruptcy by 18%. In models (6) and (7), the coefficient of CEO equity and CEO delta are -0.091 and -0.125, suggesting that a \$1 million dollar increase in equity compensation or a \$1000 increase in delta decreases probability of bankruptcy by 9.1% and 12.5%, respectively. These results indicate that equity compensation and the sensitivity of CEO wealth to stock price reduce probability of bankruptcy. This is consistent with our argument that CEO compensation that encourages risk-aversion decreases the likelihood of bankruptcy as managers tend to be more cautious in their risk-taking behavior.

In models (8) through (10) of Table 2.4, we examine the effects of CEO compensation variables on probability of bankruptcy when other compensation characteristics are included in these regressions. Since we proxy inside debt with three variables, we estimate three separate models. While the magnitude and statistical significance of the effects of compensation variables on probability of bankruptcy changes, we still find that cash compensation and CEO vega are positively related, while inside debt and delta are negatively associated with bankruptcy. We also find that when we include other compensation variables in the models, the coefficients of CEO equity holding become statistically insignificant in all three models. We argue that this is probably due to vega since it captures the convexity of compensation package. In other words, we argue that the sensitivity of stock return volatility is more important than the size of equity holding in determining probability of bankruptcy. In model (8), we find that inside debt, when proxied by sum of pension and deferred compensation, is statistically significant at 5% level. This supports our hypothesis that conservative CEOs are less likely to be associated with the likelihood of bankruptcy.

[Insert Table 2.4 about here]

In Table 2.5, we include three CEO characteristic variables in our regression models. In model (1), the results indicate that the positive effect of cash compensation becomes statistically insignificant when we include CEO characteristics. We argue that the effects of CEO characteristics are important in determining the impact of cash compensation on bankruptcy. In specification (2) to (7), the individual effect of each component of compensation structure is consistent with Table 2.4, with different probabilities and statistical significance. In model (8), we consider all the components of compensation. We find that only CEO inside debt and vega are statistically significant, whereas other compensation components become insignificant. When we

proxy for inside debt by high CEO relative leverage, we find consistent results. The results indicate that the coefficients of CEO age are negatively associated with probability of bankruptcy. Literature shows that younger CEOs are associated with riskier corporate policies (Yim 2013; Serfling 2014). Younger CEOs are also found to be associated with stock price crash caused by revelation of negative news (Andreou, Louca & Petrou 2017). This may indicate market's perception about the riskiness associated with the corporate decisions taken by younger CEOs. Lending support to the previous literature, our results indicate that older CEOs, by virtue of their wisdom and prudence in making wise corporate decision, are more likely to deter bankruptcy. Previous research shows that outsider CEOs perform either extremely good or extremely bad as compared to insider CEOs (Quigley *et al.* 2019). Our finding indicates that, in general, outsider CEOs are likely to improve the financial performance of firms and thereby, likely to reduce probability of bankruptcy.

[Insert Table 2.5 about here]

3.4. Robustness check: non-linearity test with inside-debt

Scholarly research shows that CEOs with inside-debt related compensation are likely to behave like creditors and manage their firms more conservatively. That is, they prefer making less risky management decisions. Following the contradictory prediction of signaling view and wealth transfer view – one favors inside debt to be in line with creditors' interest by protecting firm liquidity while the later claims that inside debt expropriates firm liquidity – Caliskan and Doukas (2015) argue that CEOs with high inside debt are likely to pursue conservative policies, such as payment of dividend. Based on this contradictory prediction, they argue that the relation between inside debt and dividend payment is non-linear. In line with Caliskan and Doukas (2015), we also argue that the relationship between inside debt and probability of bankruptcy may also be non-

linear. We test this possibility by developing two dummy variables to capture high inside debt and high CEO relative leverage. We substitute the original inside debt variables with these two dummy variables to test the possibility of non-linearity issue. The results are presented in Table 2.6. Column (1) of Table 2.6 shows the results when we use *High Inside Debt* dummy variable as a proxy for inside debt. The results indicate that for 1% increase in high inside debt, probability of bankruptcy decreases by 41.7%. Column (2) indicates that for 1% increase in *High Relative Leverage*, probability of bankruptcy decreases by 39.3%. Therefore, comparing the coefficients of *High Inside Debt* and *High Relative Leverage* with the coefficient of *Inside Debt* (column 2 of Table 2.4), the results show that the presence of high inside debt and high relative leverage in CEO compensation decrease the likelihood of bankruptcy substantially. We find the same pattern in column (2) when we substitute the high inside debt dummy with the high relative leverage dummy. In column (3), we account for the combined effect of CEO *High Relative Leverage*, *Cash Compensation*, and *CEO Vega*. The results show that in the presence of cash compensation, the positive effect of CEO vega exacerbates bankruptcy likelihood (62.1%), compared to 11.3% when we consider *Relative Leverage* (column (9) of Table 2.4). Column (3) of Table 2.6 also indicates that though the negative effect of high relative leverage on bankruptcy persists, the economic effect decreases to some extent (39.3% and 28.8% in columns (2) and (3), respectively). In column (4), we account for the effect of high inside debt, CEO equity holding and CEO delta along with other compensation components. The results show that the presence of equity-holding and delta weaken the positive effect of vega (from 62.1% to 16.2% in columns (3) and (4), respectively). At the same time, considering the effect of high inside debt in column (4) reduces the negative effect of high relative leverage to some extent, though the economic effect remains statistically significant (28.8% and 26.2% in columns (3) and (4), respectively). We extend our analyses to account for

the effects of high inside debt, cash compensation and CEO delta along with three CEO characteristics in column (5) and (6). Consistent with our expectation, in column (5), CEO delta is negatively associated bankruptcy, while the coefficients of high inside and cash compensation become statistically insignificant. In column (6), the coefficient *Outsider Dummy* is negative and significant, while high relative leverage dummy and CEO delta are negatively and significantly associated with bankruptcy. Overall, comparing the results of our analyses for different combination of compensation components, we may conclude that the proportion of different types of compensation components are likely to be associated with probability of bankruptcy.

[Insert Table 2.6 about here]

3.5. Robustness check: Risk-inducing compensation, firm focus and bankruptcy

Research shows contradictory findings regarding the effects of corporate diversification. For example, Wernerfelt and Montgomery (1988) and Lang and Stulz (1994) conclude that narrowly focused firms do better than widely focused firms when using Tobin's q as a measure of firm performance. However, Lewellen (1971) argue that in the presence of imperfect capital market, higher level of diversification reduces probability of bankruptcy. Mansi and Reeb (2002) supports to this argument and show that diversified firms experience downward bias in the book value of their debt when used as a proxy for market value of debt. Villalonga (2004) provides evidence that on average diversification does not destroy firm value. Leland (2007) supports the argument and shows that diversified firms may have a higher value. More recently, Singhal and Zhu (2013) find that corporate diversification may reduce the risk of distress. Investigating the relation between managerial compensation and the extent of diversification, Denis, Denis and Sarin (1997) find that managerial equity compensation is negatively associated with the extent of diversification. Coles *et al.* (2006) complement the findings of Denis *et al.* (1997) by showing that

CEO vega is positively associated with fewer lines of business. In other words, CEOs with higher vega increase the riskiness of their business by diversifying less and focusing on fewer line of business. However, as evidenced by Shin and Stulz (1998), if the investment of one segment of a diversified firm is less sensitive to the cash flows generated by itself and more sensitive to cash flows generated by other firm segments, then we can expect that in the event of financial distress of one segment, other profitable segments can rescue the distressed segment and help it by pursuing positive NPV investment opportunities. Therefore, it can be expected that more diversified firms are less likely to be associated with bankruptcy as long as these firms remain within their boundaries in term of their transaction costs (Coase 1937). Based on these previous findings, we argue that firm diversification may further reduce the possibility of bankruptcy when diversified firms are run by CEOs with risk-averse inducing compensation structures. We also argue that firm diversification reduces the positive effect of risk-seeking inducing compensation on bankruptcy. In other words, quantitatively, we expect a negative association between probability of bankruptcy and inside debt as well as CEO delta to be stronger while the positive association between cash compensation and CEO vega to be weaker.

The results are presented in Table 2.7. In column (1) of Table 2.7, we show the additional effects of the number of firm segments and cash compensation. Relative to our baseline model in column (1) of Table 2.4, the positive association of cash compensation with bankruptcy weaken by (23.4% - 21.3%) 2.1%. In column (2), the negative effect of inside debt on bankruptcy further strengthens when we consider firm diversification. In economic term, compared to our baseline model, inside debt reduces the likely of bankruptcy by (37.4% - 29.2%) 8.2%. In column (3), the presence of firm diversification weakens the positive impact of vega (9.8% compared to 18% in column (5) of Table 2.4). The coefficients of equity-holding and CEO delta are also consistent

with our baseline model. Specifically, we find that in the presence of firm diversification, a \$1000 increase in CEO delta reduces the likelihood of bankruptcy by 21.1% (column (5) of Table 2.7) compared to 12.5% in our baseline model (column (7) of Table 2.4). In column (6) of Table 2.7, we consider all components of compensation. Surprisingly, the results of regressions show that in the presence of firm diversification, though the positive effect of CEO vega remains almost the same when compared to our baseline model (22.8% and 22.3% in columns (10) and (10) of Table 2.4 and Table 2.7, respectively), the coefficient of cash compensation increases by (63.6% – 41.2%) 22.4%. The regression results indicate that the impact of cash compensation on probability of bankruptcy increases substantially, whereas the effects of equity-holding and CEO delta (i.e., linear compensation) become statistically insignificant. Therefore, the findings suggest that the positive impact of cash compensation and CEO risk-seeking compensation contracts on probability of bankruptcy can defy the negative effects induced by CEO equity holding and CEO delta.

[Insert Table 2.7 about here]

3.6. Robustness check: Risk-inducing compensation, leverage, firm focus and bankruptcy

In this subsection, we test another possible effect of CEO compensation structure on probability of bankruptcy. Previous literature finds that when CEO compensation structure is designed to induce pay-for-performance, CEOs are likely to prefer low firm leverage (Frank & Goyal 2007). However, while this pay-for-performance sensitivity is low during the time of financial distress, the sensitivity increases sharply after firms go through debt restructure (Gilson & Vetsuypens 1993). Ortiz-Molina (2005) finds that compensation policy related to stock options is the most sensitive to the differences in capital structure. Specifically, CEOs with stock options-based compensation can increase the value of their options by increasing the volatility of underlying stocks, which can be achieved by increasing firm risk (Cohen, Hall & Viceira 2000).

Stock return volatility can be increased by increasing the level of firm leverage, and excess leverage can lead to firm failure if firms invest in negative NPV projects. Therefore, although higher level of debt can benefit CEOs with highly convex compensation by increasing the volatility of underlying stock, excessive debt can lead to firm failure. In other words, such CEOs may not care about firm failure because they can take advantage of the rising value of their option awards.

Further, Lang, Ofek and Stulz (1996) show that for diversified firms, leverage is negatively associated with growth at the business segment level, and this negative relation is more pronounced for firms with low Tobin's q ratio. Coles *et al.* (2006) identify a positive relation between firm segment and firm leverage. Therefore, we argue that in the context of financially distressed firms with multiple firm segments, higher level of leverage – along with risk-inducing (convex) compensation structure, that is, stock options – may have a more profound effect on bankruptcy. To identify this effect, in this section we interact different components of CEO compensation with firm leverage and identify the effect of each of the interaction terms on probability of bankruptcy. Here, we replicate Table 2.7 by adding the interaction term in our model. The results are presented in Table 2.8.

Column (1) shows the effect of cash compensation on probability of bankruptcy. The estimated coefficient of cash compensation indicates that a one-percent increase in cash compensation increases probability of bankruptcy by 38.1%. This positive impact of cash compensation is higher than that in column (1) of Table 2.7. This coefficient of the interaction term indicates a much stronger positive effect of the combination of cash compensation and firm leverage. Numerically, a one-percent increase in the coefficient of the interaction term increases probability of bankruptcy by 69.5%. Most interestingly, the negative effect of diversification on probability of bankruptcy becomes statistically insignificant. This indicates that the combined

positive effect of cash compensation and firm leverage on probability of bankruptcy becomes so strong that it effectively defies the benefit of firm diversification. We find a similar result in column (3) when we consider CEO vega. In economic terms, this result indicates that a one-percent point increase in CEO vega increases probability of bankruptcy by 29.1%, whereas the interaction effect of CEO vega and firm leverage increases probability of bankruptcy by a higher percentage (36.8%). In column (2), though both inside debt and firm diversification are negatively associated with probability of bankruptcy, the coefficient of the interaction term between inside debt and firm leverage becomes statistically insignificant. In columns (4) and (5), we present the results with CEO equity holding and CEO delta. Though the negative effect of equity holding is more pronounced, the negative effect of CEO delta on probability of bankruptcy subsides. The negative coefficient of the interaction term between CEO delta and firms leverage declines further. Thus, complementing the previous literature, our results provide evidence that CEO compensation structure may influence probability of bankruptcy in varying degree by affecting firm leverage.

[Insert Table 2.8 about here]

4. Conclusion

This study examines whether risk-seeking inducing CEO compensation affects probability of bankruptcy. Using different components of CEO compensation as proxies for CEO risk-taking inducing behavior, we document that CEO cash compensation and the sensitivity of CEO equity compensation to stock return volatility (i.e., high CEO vega) increase probability of bankruptcy, whereas inside debt and the sensitivity of CEO equity compensation to stock price changes (i.e., high CEO delta) decrease probability of bankruptcy. In subsequent analysis, we also document that in diversified firms, the negative effects of inside debt and delta is stronger in further reducing

the likelihood of bankruptcy. The results indicate that though the statistical significance of the positive effect of CEO vega persists, the numerical impact decreases.

Our tests are performed using two data sets – from 1992 through 2016 and from 2006 through 2016. We use the former as our main dataset since it includes CEO delta and vega estimates of linear and convex, respectively, CEO compensation for the entire sample period. However, additional analyses of linear compensation, based on CEO inside debt data, on probability of bankruptcy cover the sample period because inside debt data are available from 2006. Consistent with the previous literature and our main findings, the results of our robustness tests indicate that the interaction effects of firm leverage with different components of CEO convex (linear) compensation further increase (decrease) the impact of compensation structure on probability of bankruptcy.

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Table 2.1: Annual distribution of sample bankruptcy filings and firm characteristics.

The table shows mean and median values of Sales, book value of total asset, and book value of total liabilities in the year prior to bankruptcy filing (millions of US dollars). In a prepackaged bankruptcy filing, the firm files a plan of reorganization jointly with its bankruptcy petition, i.e., the debt contract of the firm has been accepted by the creditor prior to the beginning of the bankruptcy process. In a pre-negotiated plan, the debtor and creditor agree upon the term of a plan and contractually bind themselves through an agreement without being engaged in voting process of Section 1126 of the bankruptcy code¹. A free fall chapter 11 is a surprise filing of bankruptcy in the bankruptcy court. The sample contains large public US firms filing for Chapter 11 from 1980 to 2016.

Filing Year	N	Sales (\$ Million)		Total Assets (\$ Million)		Total Lia. (\$ Million)		Bankruptcy Type		
		Mean	Median	Mean	Median	Mean	Median	Pre-negotiated	Prepack	Free Fall
1980	3	541.574	288.318	328.29	177.991	208.049	121.043	0	0	3
1981	5	308.19	207	698.882	446.085	712.136	368.971	0	0	5
1982	13	790.086	391.123	661.074	473.756	513.81	347.325	0	0	13
1983	5	1557.55	1427.02	2204.41	284.836	2067.81	201.497	0	0	5
1984	6	815.424	386.796	649.233	228.358	484.431	308.307	0	0	6
1985	7	567.173	370.897	556.254	389.516	464.088	293.66	0	0	7
1986	10	1071.56	202.648	1095.27	436.067	896.853	352.36	0	1	9
1987	7	4983.93	416.796	5366.49	518.26	3303.68	493.171	0	0	7
1988	12	664.961	362.699	3411.58	412.238	3239.84	433.409	0	0	12
1989	16	724.568	467.696	2150.42	1480.15	2523.38	2728.01	1	0	15
1990	30	1222.39	390.2	1230.67	556.824	1291.75	525.6	1	1	28
1991	37	730.962	498.364	994.364	427.461	1035.4	526.185	3	3	31
1992	32	959.246	518.803	1178.31	452.697	1177.15	503.58	2	9	21
1993	23	589.406	440.97	465.781	313.667	572.708	258.97	3	8	12
1994	11	606.151	508.281	405.666	346.645	398.259	276.265	1	4	6
1995	17	988.137	409.5	1081.85	665.391	1053.95	596	2	3	12
1996	14	1079.07	725.75	641.55	509	573.298	490	4	3	7
1997	16	1031.9	407.762	875.433	427.482	841.286	408.84	4	2	10
1998	30	534.491	385.416	772.598	374.1	775.751	374.186	6	3	21
1999	40	845.38	394.44	1203.87	554.583	1080.93	471.52	11	3	26
2000	70	1173.63	555.808	1110.93	472.764	1081.61	458.5	11	4	55
2001	89	2205.72	580.897	2620.58	808	2259.91	644.559	18	0	71
2002	75	2364.38	567.164	4508.34	872.9	3495.3	888.088	23	6	46
2003	55	1225.42	615.738	1674.73	635.15	1670.76	670.902	9	4	42
2004	29	981.083	436.817	996.489	476	973.613	517	9	4	16
2005	25	3607.09	716.2	5817.44	657.195	6025.97	569.73	2	2	21
2006	13	1419.1	472.045	1386.85	452.145	1305.57	541.92	5	0	8
2007	13	849.475	775.287	5183.55	871	4995.56	1390	1	3	9
2008	34	3295.1	880.833	29932.3	1038.65	28678.36	1276	4	2	28
2009	81	3828.36	841.39	5686.05	1003.98	6723.43	1240.33	25	4	52
2010	26	785.932	244.187	2202.6	944	2262.86	1016	6	6	14
2011	22	1673.8	387.161	4249.27	649.004	4168.2	623.627	6	3	13
2012	23	957.627	557.2	1862.1	690.304	1749.64	558.801	4	4	15
2013	24	659.149	444.446	1081.78	502.593	1142	571.216	6	8	10
2014	16	1206.43	390.732	3889.58	1290.83	4643.94	1070.86	6	3	7
2015	23	1152.23	569.428	2898.63	1591.2	2907.8	1378.97	11	1	11
2016	38	1127.51	797.555	2403.04	1204.74	2411.72	1600.26	11	9	18
Total	990	1327.681	514.415	2796.656	638.799	2694.886	678.261	195	103	692

¹ <http://dlgfirm.com/pre-negotiated-chapter-11-plans/>

Table 2.2: Descriptive Statistics

This table presents descriptive statistics for bankruptcy and non-bankruptcy related firms, respectively in Panels A and B. Variable definitions are reported in Appendix A. All the variables are lagged by one year.

Panel A. Descriptive statistics of bankruptcy related firms from 1992 to 2016.

Period: 1992 - 2016						
	N	Mean	Std Dev	Lower Quartile	Median	Upper Quartile
CEO Cash Compensation (\$ '000)	130	1292.180	916.017	700.008	1010.510	1583.790
CEO Inside debt (\$ '000)	45	2172.620	4692.240	0	166.874	1187.520
CEO Equity Holding (\$ '000)	130	12565.220	35255.870	769.23	3032.420	10018.200
CEO Vega	115	47.174	102.433	0	10.902	39.488
CEO Delta	116	153.534	444.167	8.981	49.201	124.716
CEO Relative Leverage	21	0.175	0.509	0	0.010	0.024
Book Leverage	90	0.426	0.165	0.324	0.452	0.560
Cash	90	0.059	0.067	0.010	0.032	0.085
Capital Exp.	89	0.058	0.050	0.024	0.046	0.072
Divident Cut	130	0.331	0.472	0	0	1
Market-to-Book	86	1.114	0.327	0.914	1.013	1.178
Net PPENT	90	0.404	0.227	0.227	0.386	0.570
R&D	130	0.005	0.020	0	0	0.000
ROA	87	0.066	0.082	0.010	0.075	0.117
Size	90	7.841	1.159	7.035	7.775	8.334
CEO Age	130	3.980	0.132	3.892	4.007	4.060
Outsider Dummy	111	0.099	0.300	0	0	0
CEO Duality	130	0.315	0.466	0	0	1

Panel B. Descriptive statistics of non-bankruptcy related firms from 1992 to 2016.

Period: 1992 - 2016						
	N	Mean	Std Dev	Lower Quartile	Median	Upper Quartile
CEO Cash Compensation (\$ '000)	33386	1059.230	799.864	550.000	839.131	1240.000
CEO Inside debt (\$ '000)	15237	4180.810	8390.040	0	320.206	4055.210
CEO Equity Holding (\$ '000)	33382	45180.450	100581.330	3638.950	11254.640	34935.690
CEO Vega	32246	43.111	60.619	0	12.617	60.887
CEO Delta	32296	1355.820	29003.060	45.097	135.709	415.309
CEO Relative Leverage	14149	0.854	1.986	0	0.054	0.715
Book Leverage	32105	0.218	0.169	0.058	0.213	0.340
Cash	32223	0.144	0.166	0.022	0.076	0.210
Capital Exp.	32039	0.057	0.050	0.023	0.042	0.074
Dividend Cut	33325	0.133	0.339	0	0	0
Market-to-Book	31837	1.967	1.193	1.201	1.562	2.253
Net PPENT	32179	0.301	0.233	0.113	0.231	0.447
R&D	33325	0.028	0.050	0	0	0.035
ROA	32177	0.136	0.089	0.090	0.133	0.185
Size	32328	7.324	1.584	6.155	7.209	8.410
CEO Age	33325	4.005	0.130	3.912	4.007	4.094
Outsider Dummy	12950	0.123	0.329	0	0	0
CEO Duality	33325	0.325	0.469	0	0	1

Panel C. Descriptive statistics from 1992 to 2005 period

This table presents descriptive statistics for all the CEOs compensations and all variables used in the analysis of CEO risk preference and corporate bankruptcy. The variable definitions are reported in Appendix A

Period: 1992 - 2005						
	N	Mean	Std Dev	Lower Quartile	Median	Upper Quartile
CEO Cash Compensation (\$ '000)	17896	1157.250	899.946	532.246	875.000	1474.790
CEO Inside debt (\$ '000)	0	.	.	.	.	.
CEO Equity Holding (\$ '000)	17895	52619.050	108232.800	4614.830	14054.460	42798.240
CEO Vega	17568	63.632	64.625	10.963	37.136	104.666
CEO Delta	17615	1314.390	13120.170	62.665	180.259	521.164
CEO Relative Leverage	0	.	.	.	.	.
Book Leverage	17374	0.224	0.165	0.073	0.224	0.345
Cash	17433	0.130	0.165	0.016	0.054	0.184
Capital Exp.	17267	0.064	0.050	0.029	0.050	0.082
Dividend Cut	17839	0.144	0.351	0	0	0
Market-to-Book	17395	2.031	1.274	1.212	1.575	2.322
Net PPENT	17397	0.330	0.229	0.146	0.271	0.486
R&D	17839	0.029	0.050	0	0	0.036
ROA	17398	0.141	0.089	0.094	0.138	0.191
Size	17513	7.154	1.536	6.008	7.012	8.176
CEO Age	17839	4.000	0.134	3.912	4.007	4.094
Outsider Dummy	5175	0.184	0.388	0	0	0
CEO Duality	17839	0.488	0.500	0	0	1

Panel D. Descriptive statistics from 2006 to 2016 period

This table presents descriptive statistics for all the CEOs compensations and all variables used in the analysis of CEO risk preference and corporate bankruptcy. The variable definitions are reported in Appendix A

Period: 2006-2016						
	N	Mean	Std Dev	Lower Quartile	Median	Upper Quartile
CEO Cash Compensation (\$ '000)	15620	948.871	650.986	571.327	815.168	1081.250
CEO Inside debt (\$ '000)	15282	4174.900	8382.160	0	319.836	4045.830
CEO Equity Holding (\$ '000)	15617	36385.310	89892.060	2763.170	8615.580	26123.360
CEO Vega	14793	18.681	44.462	0	0	8.397
CEO Delta	14797	1395.720	40387.010	32.432	95.105	290.946
CEO Relative Leverage	14170	0.853	1.985	0	0.054	0.713
Book Leverage	14821	0.212	0.173	0.041	0.202	0.333
Cash	14880	0.160	0.165	0.034	0.100	0.233
Capital Exp.	14861	0.050	0.049	0.018	0.034	0.063
Dividend Cut	15616	0.122	0.327	0	0	0
Market-to-Book	14528	1.886	1.082	1.185	1.538	2.182
Net PPENT	14872	0.269	0.233	0.087	0.187	0.392
R&D	15616	0.028	0.049	0	0	0.033
ROA	14866	0.131	0.088	0.086	0.127	0.177
Size	14905	7.527	1.614	6.357	7.456	8.645
CEO Age	15616	4.009	0.125	3.932	4.007	4.094
Outsider Dummy	7886	0.083	0.276	0	0	0
CEO Duality	15616	0.139	0.346	0	0	0

Panel E. Univariate Analysis

The table reports difference between the means of independent and control variables related to bankrupt and non-bankrupt companies. Variable definitions are reported in Appendix A. *Bankruptcy* is a dummy variable that takes a value of 1 if a firm has already filed for Chapter 11, and zero otherwise. ***, **, and * denote significant at 1%, 5%, and 10% level, respectively.

	Bankruptcy = 1	Bankruptcy = 0	Difference between means	t-Value
Cash	1292.18	1059.23	232.95	2.90***
Compensation	2172.62	4180.81	2008.19	2.86***
Inside debt	12565.22	45180.45	32615.23	10.38***
Equity Holding	47.17	43.11	4.06	2.11**
Vega	153.53	1355.82	1202.29	8.41***
Delta	0.17	0.85	0.68	5.60***
Relative Lev.	0.43	0.22	0.21	11.89**
Book Leverage	0.06	0.14	0.08	12.03***
Cash	0.06	0.06	0.00	0.12
Capital Exp.	0.33	0.13	0.20	4.77***
Dividend Cut	1.11	1.97	0.86	23.74***
Market-to-Book	0.40	0.30	0.10	4.30***
Net PPENT	-0.06	0.04	0.10	8.64***
Profit	0.01	0.03	0.02	12.97***
R&D	0.07	0.14	0.07	8.02***
ROA	7.84	7.32	0.52	4.23***
Size	3.98	4.00	0.02	2.13**
CEO Age	0.10	0.12	0.02	0.84
Outsider Dummy	0.32	0.33	0.01	0.81
CEO Duality				

Table 2.3: Correlation Coefficients

The table presents the Pearson correlations for the sample observations of all the variables used. ***, **, and * denote significant at 1%, 5%, and 10% level, respectively. All the variables are reported in Appendix A.

	Bankruptcy	CEO Cash Compen	CEO Inside debt	CEO Equity Holding	CEO Vega	CEO Delta	CEO Relative Leverage	Book Leverage	Surplus Cash	Capital Exp.	Dividend Cut	Market-to-Book	Net PPENT	R&D	ROA	Size	CEO Age	Outsider Dummy
CEO Cash Compen	0.018***	1																
CEO Inside debt	-0.013**	0.351***	1															
CEO Equity Holding	-0.020**	0.207***	0.105***	1														
CEO Vega	0.008***	0.471***	0.100***	0.201***	1													
CEO Delta	-0.002**	0.001	0.003	0.188***	0.006	1												
CEO Relative Leverage	-0.013	0.107***	0.398***	-0.121***	-0.086***	-0.013	1											
Book Leverage	0.065***	0.143***	0.155***	-0.083***	0.064***	-0.018***	-0.008	1										
Surplus Cash	-0.027***	-0.172***	-0.209***	0.072***	-0.042***	0.024***	-0.072***	-0.464***	1									
Capital Exp.	0.001	-0.035***	0.003	0.055***	-0.005	-0.012**	-0.040***	0.035***	-0.189***	1								
Dividend Cut	0.036***	0.027***	0.027***	-0.030***	0.017***	-0.008	0.018**	0.088***	-0.087***	-0.029***	1							
Market-to-Book	-0.037***	-0.001	-0.050***	0.291***	0.091***	0.037***	0.040***	-0.328***	0.398***	0.062***	-0.109***	1						
Net PPENT	0.023***	0.016***	0.114***	-0.050***	-0.007	-0.022***	0.006	0.315***	-0.428***	0.642***	0.055***	-0.215***	1					
R&D	-0.029***	-0.130***	-0.130***	0.002	0.028***	0.006	-0.036***	-0.315***	0.550***	-0.144***	-0.104***	0.314***	-0.352***	1				
ROA	-0.041***	0.138***	0.064***	0.154***	0.075***	0.014**	0.107***	-0.126***	-0.116***	0.250***	-0.052***	0.412***	0.098***	-0.185***	1			
Size	0.017***	0.533***	0.500***	0.161***	0.315***	0.060***	0.195***	0.379***	-0.365***	-0.021***	0.060***	-0.187***	0.222***	-0.261***	0.051***	1		
CEO Age	-0.012**	0.133***	0.214***	0.092***	0.006	0.021***	0.089***	0.050***	-0.137***	-0.029***	0.045***	-0.097***	0.072***	-0.122***	0.036***	0.144***	1	
Outsider Dummy	-0.007	-0.001	-0.047***	-0.028***	0.059***	-0.013	-0.011	-0.020**	0.035***	-0.038***	0.044***	-0.004	-0.039***	0.067***	-0.044***	-0.056***	0.001	1
CEO Duality	-0.001	0.153***	0.093***	0.117***	0.182***	0.024***	0.036***	0.066***	-0.129***	0.085***	0.031***	0.020***	0.092***	-0.058***	0.087***	0.072***	0.149***	0.051***

Table 2.5: Extended baseline regression with executive characteristics

The table presents the results of the logistic regression in which the dependent variable is one if the firm goes bankrupt at time t, and zero otherwise. Presented in the parenthesis are the t-values. All the variables related to company and CEO variables are reported in detail in Appendix A. ***, **, and * denote significant at 1%, 5%, and 10% level, respectively. All models include industry and year dummies.

Variables	DV = Bankruptcy Dummy									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Cash Compensation	0.099 (0.37)							0.177 (0.69)	0.409** (4.69)	0.351 (2.48)
Inside debt		-0.169** (5.01)						-0.081** (4.63)		
Relative Leverage			-0.016 (0.04)						-0.098 (1.68)	
CEO Relative Leverage Dum.				-0.183* (3.53)						-0.238* (3.70)
CEO Vega					0.376*** (33.49)			0.122*** (13.97)	0.320*** (5.54)	0.442*** (28.72)
Equity Holding						-0.098** (5.11)		-0.036 (0.41)	-0.31 (0.53)	0.034 (0.09)
CEO Delta							-0.165** (4.16)	-0.157 (1.77)	-0.791 (0.35)	-0.965 (1.74)
Capital Exp.	-0.673 (0.44)	-0.987** (4.70)	-0.998** (4.30)	-0.707 (0.53)	-0.745 (0.50)	-0.634 (0.35)	-0.678 (0.44)	-0.793 (0.54)	-0.898 (2.36)	-0.459 (0.08)
R&D	-0.905 (1.16)	0.459 (0.16)	0.154 (0.48)	-0.991 (1.11)	-0.991 (2.59)	-0.992 (1.03)	-0.996 (0.83)	0.887 (0.04)	0.173 (0.20)	-0.992 (2.29)
Book Leverage	0.677*** (41.78)	0.338*** (9.51)	0.133*** (17.44)	0.227*** (40.07)	0.918*** (38.80)	0.294*** (40.84)	0.493*** (40.56)	0.254*** (5.71)	0.429** (5.01)	0.502*** (34.36)
Market-to-Book	-0.586*** (8.08)	-0.566 (0.77)	-0.773** (4.10)	-0.57*** (7.51)	-0.343 (1.62)	-0.515** (5.53)	-0.522** (5.26)	-0.141 (1.33)	-0.815 (0.52)	-0.183 (0.32)
ROA	-0.987*** (15.58)	-0.997 (2.64)	-0.988** (4.77)	-0.986*** (15.04)	-0.995*** (16.88)	-0.983*** (13.74)	-0.985*** (14.58)	-0.806*** (2.47)	-0.799* (3.57)	-0.993*** (20.59)
Net PPENT	0.94 (1.76)	0.457 (0.67)	0.104** (4.32)	0.9 (1.66)	0.570 (0.64)	0.807 (1.41)	0.692 (1.10)	0.279 (0.17)	0.674 (2.44)	0.627 (0.67)
Size	0.042 (0.32)	-0.295 (1.69)	-0.149 (1.10)	0.07 (1.48)	-0.015 (0.05)	0.123* (3.68)	0.011 (0.03)	-0.039 (0.25)	-0.707 (2.00)	-0.165 (1.89)
Cash	0.406 (0.11)	0.516 (0.00)	5.585 (0.65)	0.303 (0.07)	0.921 (0.31)	0.237 (0.04)	0.324 (0.07)	-0.147 (0.03)	0.837 (0.12)	1.696 (0.68)
Dividend Cut Dummy	0.082 (0.22)	1.918 (2.68)	0.864 (2.28)	0.069 (0.16)	-0.215 (1.40)	0.025 (0.02)	0.051 (0.09)	-0.046 (0.06)	0.501 (0.04)	-0.227 (1.50)
CEO Age	-0.682** (4.57)	-0.328 (2.33)	-0.245 (0.05)	-0.669** (4.32)	-0.560 (1.74)	-0.625* (3.26)	-0.631* (3.18)	-0.221* (3.09)	-0.992 (0.56)	-0.539 (1.33)
Outsider CEO	-0.264 (1.62)	0.835 (0.54)	0.647 (0.92)	-0.248 (1.40)	-0.532** (5.04)	-0.253 (1.44)	-0.24 (1.26)	-0.115* (3.22)	-0.994 (1.08)	-0.571** (5.49)

Table 2.6 – Robustness test: Inside debt and non-linearity

The table presents the results of the logistic regression in which the dependent variable is one if the firm goes bankrupt at time t , and zero otherwise. Presented in the parenthesis are the t -values. All the variables related to company and CEO variables are reported in detail in Appendix 2.A. ***, **, and * denote significant at 1%, 5%, and 10% level, respectively. All models include industry and year dummies.

Variables	DV = Bankruptcy Dummy					
	(1)	(2)	(3)	(4)	(5)	(6)
High Inside Debt	-0.417* (3.76)			-0.197 (0.17)	-0.159 (0.76)	
High Relative Leverage		-0.393* (3.70)	-0.288** (4.55)	-0.262* (3.51)		-0.265** (4.61)
Cash Compensation	0.229*** (7.00)	0.222*** (6.69)	0.334*** (9.36)	0.335*** (9.40)	0.095 (0.97)	0.126 (1.48)
CEO Vega			0.621*** (36.49)	0.162*** (36.47)		0.159*** (38.46)
Equity Holding			-0.028 (0.35)	-0.030 (0.37)		-0.076 (3.97)
CEO Delta			-0.279 (0.63)	-0.284 (0.65)	-0.224*** (5.58)	-0.291*** (7.50)
Capital Exp.	0.154 (0.02)	0.147 (0.02)	1.304 (0.61)	1.329 (0.62)	-0.404 (0.21)	-0.473 (0.29)
R&D	-0.827 (0.55)	-0.817 (0.51)	-0.938 (1.29)	-0.938 (1.28)	-0.902 (0.90)	-0.976 (2.85)
Book Leverage	0.494*** (39.59)	0.473*** (37.94)	0.529*** (34.89)	0.526*** (34.70)	0.862*** (48.09)	0.851*** (46.29)
Market-to-Book	-0.378*** (10.80)	-0.377*** (10.60)	-0.180 (1.67)	-0.179 (1.65)	-0.303** (5.20)	-0.073 (0.60)
ROA	-0.972*** (29.34)	-0.971*** (28.84)	-0.981*** (27.92)	-0.981*** (27.93)	-0.966*** (21.73)	-0.976*** (27.49)
Net PPENT	0.874** (5.86)	0.880** (5.95)	0.771** (4.01)	0.771** (4.00)	0.531 (1.91)	0.432 (1.23)
Size	-0.004 (0.01)	-0.006 (0.03)	-0.053 (0.99)	-0.054 (1.01)	-0.015 (0.11)	0.017 (0.12)
Cash	0.265 (0.22)	0.184 (0.11)	0.348 (0.27)	0.324 (0.24)	0.542 (0.72)	0.854 (1.66)
Dividend Cut	-0.012 (0.02)	-0.009 (0.01)	-0.157 (2.39)	-0.157 (2.39)	0.024 (0.05)	-0.131 (1.41)
CEO Age					-0.456 (3.20)	-0.360 (1.55)
Outsider CEO					-0.172 (1.81)	-0.341** (5.85)
CEO Duality					-0.017 (0.02)	0.068 (0.35)
No. of Observation	30639	30639	29844	29844	10365	10107
Pseudo R2	0.3077	0.3064	0.3878	0.3879	0.49	0.6035
Industry FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Table 2.7 – Robustness test - Effects of firm focus and CEO incentives on bankruptcy

The table presents the results of the logistic regression in which the dependent variable is one if the firm goes bankrupt at time t, and zero otherwise. Presented in the parenthesis are the t-values. All the variables related to company and CEO variables are reported in detail in Appendix 2.A. ***, **, and * denote significant at 1%, 5%, and 10% level, respectively. All models include industry and year dummies.

Variables	DV = Bankruptcy Dummy					
	(1)	(2)	(3)	(4)	(5)	(6)
Number of Segments	-0.111** (4.03)	-0.222** (5.76)	-0.445* (3.20)	-0.133* (3.06)	-0.196* (2.80)	-0.152* (3.34)
Cash Compensation	0.213*** (8.58)					0.636*** (8.60)
Inside Debt		-0.374** (5.79)				
CEO Vega			0.098*** (31.78)			0.223*** (18.83)
Equity Holding				-0.150*** (14.34)		-0.095 (1.50)
CEO Delta					-0.211** (4.83)	-0.415 (0.36)
Capital Exp.	-0.300 (0.08)	-0.789 (0.09)	0.673 (0.08)	0.158 (0.01)	0.132 (0.01)	0.669 (0.26)
R&D	-0.332 (0.03)	-0.096 (0.38)	-0.614 (0.06)	-0.056 (0.00)	-0.536 (0.04)	-0.624 (0.05)
Book Leverage	0.880*** (40.08)	0.397*** (7.95)	0.150*** (27.09)	0.121*** (26.91)	0.126*** (27.49)	0.177*** (27.67)
Market-to-Book	-0.173 (2.09)	-0.564 (0.07)	-0.161 (0.58)	-0.161 (0.61)	-0.140 (0.42)	-0.128 (0.31)
ROA	-0.965*** (17.69)	-0.639 (1.12)	-0.986*** (11.67)	-0.970*** (9.43)	-0.975*** (10.62)	-0.989*** (12.52)
Net PPENT	0.291** (5.51)	0.315 (1.38)	0.418* (3.11)	0.048 (2.26)	0.992 (2.14)	0.872** (4.15)
Size	-0.009 (0.03)	0.433 (1.78)	0.076 (1.59)	0.212*** (10.06)	0.061 (1.08)	-0.019 (0.04)
Cash	0.294 (2.42)	0.394 (0.00)	0.798 (1.32)	0.141 (0.79)	0.584 (1.25)	0.262 (1.88)
Dividend Cut	0.048 (0.15)	0.472 (0.05)	-0.119 (0.50)	0.001 (0.00)	0.023 (0.02)	-0.110 (0.42)
Stock Return	-0.501*** (18.03)	-0.993 (2.28)	-0.361* (3.59)	-0.436*** (6.79)	-0.478*** (8.40)	-0.400** (4.17)
No. of Observation	25038	7170	24683	25038	24999	24664
Pseudo R2	0.4321	0.9206	0.4469	0.4058	0.3992	0.4646
Industry FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Table 2.8 – Robustness test - Effects of firm focus and CEO incentives & leverage on bankruptcy

The table presents the results of the logistic regression in which the dependent variable is one if the firm goes bankrupt at time t, and zero otherwise. Presented in the parenthesis are the t-values. All the variables related to company and CEO variables are reported in detail in Appendix 2.A. ***, **, and * denote significant at 1%, 5%, and 10% level, respectively. All models include industry and year dummies.

Variables	DV = Bankruptcy Dummy				
	(1)	(2)	(3)	(4)	(5)
Number of Segments	-0.125 (2.66)	-0.218** (4.53)	-0.113* (3.08)	-0.039* (3.36)	-0.127* (2.81)
Cash Compensation	0.381*** (18.58)				
Inside Debt		-0.290** (5.89)			
CEO Vega			0.291** (4.23)		
Equity Holding				-0.564* (2.89)	
CEO Delta					-0.138** (4.49)
Capital Exp.	-0.298 (0.04)	-0.311 (0.03)	0.279 (0.03)	0.237 (0.01)	0.385 (0.03)
R&D	-0.147 (0.00)	-0.469 (0.15)	-0.196 (0.01)	0.446 (0.01)	-0.621 (0.06)
Book Leverage	0.997*** (15.50)	0.339*** (11.75)	0.178*** (16.10)	0.982*** (20.54)	0.200*** (34.13)
Market-to-Book	-0.371* (3.11)	-0.679 (0.06)	-0.055 (0.33)	-0.220 (1.18)	-0.129 (0.37)
ROA	-0.988*** (13.69)	-0.166 (1.03)	-0.967*** (19.00)	-0.977*** (9.90)	-0.976*** (10.52)
Net PPENT	0.863** (4.58)	0.738 (0.93)	0.939* (3.40)	0.131* (2.95)	0.937 (0.05)
Size	-0.03 (0.24)	0.129 (1.09)	0.057 (1.88)	0.198*** (8.64)	0.053 (0.83)
Cash	0.803 (1.39)	0.904 (0.01)	0.984 (1.75)	0.153 (1.15)	0.121 (0.85)
Dividend Cut	0.071 (0.18)	0.811 (0.06)	-0.077 (0.37)	0.001 (0.00)	0.013 (0.01)
Stock Return	-0.566*** (12.21)	-0.990 (1.16)	-0.298** (5.39)	-0.433** (6.48)	-0.461*** (7.61)
Cash Compensation*Book Lev	0.695*** (11.69)				
Inside Debt*Book Lev		-0.749 (0.18)			
Vega*Book Lev			0.368*** (16.50)		
Equity Holding*Book Lev				-0.194*** (12.85)	
Delta*Book Lev					-0.098** (5.51)
No. of Observation	25038	7170	24683	25038	24999
Pseudo R2	0.4137	0.9450	0.5093	0.4244	0.4060
Industry FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y

ESSAY 3: DOES CEO OVERCONFIDENCE MATTER FOR CORPORATE FAILURE?

1. Introduction

The term overconfidence is used to describe a human trait that descends from the field of psychology. Extant literature has identified a wide spectrum of activities that are influenced by human overconfidence. For example, overconfidence can cause strikes, business failure, stock market bubble, etc. (Neale and Bazerman 1985; Camerer and Lovallo 1999; Odean 1999; Malmendier and Tate 2005; Glaser and Weber 2007). The finance literature has identified that CEO overconfidence can affect a wide area of corporate activities. For example, overconfident CEOs affect corporate investment, M&A, dividend policy, innovation, etc. (Malmendier and Tate 2005; Brown and Sarma 2007; Galasso and Simcoe 2011; Deshmukh, Goel and Howe 2013). However, there is no consensus in the literature about the consequences of CEO overconfidence. Though some studies imply that an overconfident CEO tend to adversely affect corporations, there are other studies that establish the benefits associated with overconfident CEOs. Investigating the negative implications of CEO overconfidence, Malmendier and Tate (2008) show that overconfident CEOs are associated with value destroying mergers, as they tend to over-estimate their ability to generate firm value, which leads them to overpay for acquiring target companies. Furthermore, overconfident CEOs are likely to increase corporate financial distress (Ho 2009), and when overconfident CEOs spend more on R&D, the spending does not necessarily contribute in increasing firm value (Chen, Ho and Ho 2014). On the other hand, many prior studies also report that though overconfident CEOs increase corporate risk-taking, this increased risk-taking improves the efficiency of capital allocation and increases firm value (Hongbo 2013). These CEOs have been found to invest more in innovative projects resulting in a much higher level of success for a given level of R&D expenditures (Hirshleifer, Low and Teoh 2012).

Overconfident CEOs tend to think that they are more knowledgeable about their job and can create better than expected corporate results from the decisions they make, that is, the potential outcome of their actions will be better than what other contemporaneous CEOs will experience. Since CEOs are the top decision makers inside firms, the stream of literature that argues about the negative consequences of overconfidence shows that these CEOs are involved in value destroying decisions. Hence, they overestimate the associated future cash flows of the projects they undertake and, as a result, their miscalculation brings about loss for the firms they lead (Malmendier and Tate 2005, 2008). Further, as a result of their miscalculation, they may also accept negative NPV projects and reject positive NPV projects when they need to rely on external financing (Heaton 2002). Hackbarth (2008) has presented evidence that overconfident managers tend to use more debt financing when they perceive their firm to be less risky and therefore, less likely to experience financial distress. Complementing this findings, Malmendier, Tate and Yan (2011) show that overconfident CEOs are more likely to raise debt capital because they believe that their firms' equities are undervalued. Since overconfident CEOs inaccurately consider external financing mispriced and assume that the cost of external financing does not result in better performance of their firms in a long run, hence they rely more on short-term debt rather than long-term debt – with the hope that they can refinance later and thus, minimize the overall cost of external financing (Huang, Tan and Faff 2016). All these findings may lead to the conclusion that overconfident CEOs are more likely to be associated with corporate bankruptcy. Although several prior studies investigate the impact of CEO overconfidence on various associated corporate decisions, less attention has been given to the question whether probability of bankruptcy is related to overconfident CEOs as a result of their overoptimistic managerial abilities and foresight.

Therefore, in this paper we investigate whether CEO overconfidence can increase probability of bankruptcy.

There are plenty of finance literature which shows that CEO overconfidence may not always be damaging for firms. Galasso and Simcoe (2011) indicate that overconfident CEOs are more likely to be associated with citation-weighted patent counts and the effect is more pronounced in competitive industries. This may suggest that this group of CEOs are more innovative and prudent. In line with Galasso and Simcoe, Hirshleifer *et al.* (2012) find that overconfident CEOs invest more in R&D, and in innovative industries these CEOs are more productive and generate positive outcomes. This is indicative of the fact the overconfident CEOs are more likely to generate return on their risky investment projects compared to other CEOs. Therefore, when an overconfident CEO is appointed, shareholders may expect higher level of return from the investment decisions made by an overconfident CEO. Since, overconfident CEOs raise the expectations of shareholders, they want to keep up with their promises. Hilary, Hsu, Segal and Wang (2016) find that when CEOs are over optimistic, they put more effort to fulfill their over-optimistic goals and as a result, these CEOs are associated with both increasing ROA and market returns. Although Hilary *et al.* (2016) distinguish between overconfidence and over-optimism, their model indicates a strong connection between these two factors and the corresponding connection with CEO effort and firm performance. We contribute to this line of literature by examining the relation between CEO overconfidence and probability of bankruptcy, which has been overlooked by the previous literature. In particular, we use CEO option holding and exercise behavior as a proxy for overconfidence (Malmendier and Tate 2005; Campbell *et al.* 2011) and investigate its relationship with the bankruptcy score, determined by following the hazard model developed by Shumway (2001). Investigating the relation between the two, we find

that overconfident CEOs are less likely to be associated with probability of bankruptcy, whereas less confident (or diffident) CEOs are more likely to be associated with probability of bankruptcy.

To the best of our knowledge, this is the first paper to explore the relationship between CEO overconfidence and probability of bankruptcy based on the US data. Our research relates to several strands of literature that explore CEO confidence as well as probability of bankruptcy (see Campbell *et al.* (2011), Chava and Jarrow (2004), Shumway (2001)). We provide clear evidence that different levels of CEO confidence are associated with different probabilities of bankruptcy. We also provide empirical evidence on the moderating effects of institutional holdings, board size, board independence, agency cost, etc. on probability of bankruptcy. Thus our study also contributes to the literature on the corporate governance and its moderating effects on managerial overconfidence (Banerjee, Humphery-Jenner and Nanda 2015; Banerjee, Dai, Humphery-Jenner and Nanda 2020).

Our findings are robust to a battery of additional tests. First, we examine how board size and composition of board of directors affect the impact of different level of confidence on probability of bankruptcy. Yermack (1996) indicates an inverse relation between board size and market valuation of firms. Eisenberg, Sundgren and Wells (1998) and Mak and Kusnadi (2005) also find a significant inverse relation between board size and profitability of failure for small and midsize firms. In view of these previous findings, we test the possibility of the moderating effects of board size and board composition on the relationship between CEO overconfidence and probability of bankruptcy. Our results indicate that board size further reduces probability of bankruptcy of firms run by overconfident CEOs, whereas it strengthens the positive relationship between low confidence and probability of bankruptcy.

In our second robustness test, we examine the impact of the presence of institutional investors on the relationship between different level of CEO confidence and bankruptcy. We test this possibility because previous literature finds a positive relation between institutional investor holding and firm performance (McConnell and Servaes 1990; Woidtke 2002; Elyasiani and Jia 2010). Therefore, it may be expected that the presence of institutional investors would reduce the likelihood of bankruptcy. Our results indicate that the presence of institutional investors strengthen the negative relation between overconfident CEOs and probability of bankruptcy.

Our third robustness check follows Huang *et al.* (2016) who find that overconfident CEOs tend to use short-term debt financing which, in turn, creates high liquidity risk. This may substantially increase probability of bankruptcy. This is because overconfident CEOs tend to assume that they can refinance short-term debt at a lower cost in favorable time and, therefore, they overestimate their ability to increase shareholders' wealth. Consistent with prior findings, the results of our analysis indicate that though CEO overconfidence is negatively associated with probability of bankruptcy, the interaction between CEO overconfidence and short-term debt is positively associated with the likelihood of bankruptcy.

In our fourth robustness test, we examine whether our findings are robust for firms with and without short-term debt. According to Diamond (1991) firms that have private information prefer to issue short-term debt. Although it increases liquidity risk of firms, such issuance does not impact firms with high credit quality. On the other hand, since firms with low credit quality are unable to issue long-term debt, these firms are forced to take short-term debt which increases their liquidity risk. Our results indicate that for firms with high short-term debt, the inverse relation between CEO overconfidence and probability of bankruptcy strengthens whereas, the positive relation between low level of confidence and the likelihood of bankruptcy strengthens.

In our fifth robustness test, we examine the impact of high and low agency costs on the relation between different CEO confidence level and probability of bankruptcy. According to Jensen and Meckling (1976) managers of firms with excess cash flow may over-invest for private benefits. Further, Huang, Jiang, Liu & Zhang (2011) find that overconfident CEOs with agency costs may affect firm investment decisions. An open question is how the presence of agency costs impacts the relation between overconfidence and probability of bankruptcy. In particular, we argue that the misalignment of interests between agent and principal may affect probability of bankruptcy. Our results indicate that the presence of high agency costs further reduces probability of bankruptcy for firms managed by overconfident CEOs.

In our sixth and final robustness check, we examine the relation between different levels of CEO confidence on the likelihood of bankruptcy for firms with and without credit ratings. This test is motivated by previous research which shows a positive relation between CEO overconfidence and bank risk-taking (Niu 2010). Related research also reports that firms with high credit rating tend to enjoy more freedom in terms of financial flexibility (Graham and Harvey 2001) and are significantly less underpriced compared to firms without credit rating because credit rating reduces uncertainty about firm value (An and Chan 2008). The result of our analysis indicates that for firms without credit rating, the inverse effect of CEO overconfidence on probability of bankruptcy is more pronounced than the negative effect of CEO overconfidence on probability of bankruptcy for firms with credit rating.

The remainder of the paper is organized as follows. Section 2 presents the literature review and the hypothesis development. Section 3 describes our empirical models, data sources of the sample, definitions, and descriptive statistics. Section 4 presents and discusses the results of our empirical analysis, including the robustness checks. Section 5 concludes.

2. Literature review and hypothesis development

2.1. CEO Overconfidence

Our goal is to investigate whether overconfident CEOs are associated with corporate bankruptcy. Camerer and Lovallo (1999) argue that high rate of new business failure may be associated with managerial overconfidence. Malmendier and Tate (2005) point out that overconfident CEOs miscalculate the estimated return on their investment projects and undertake value-destroying mergers. They find that the market reacts negatively to merger announcements of overconfident CEOs. Doukas and Petmezas (2007) indicate that the wealth effects associated with high order of acquisitions are lower than the wealth effects associated with lower order of acquisitions – as the market perceives the lower order of acquisitions to be associated with ability of the CEO, whereas the higher order acquisitions are associated with managerial overconfidence. Overconfident CEOs are also more likely to pay lower level of dividends if they perceive higher investment needs (Ben-David, Graham and Harvey 2007). Ahmed and Duellman (2013) find that overconfident CEOs are more likely to be associated with loose accounting practices as well as delayed loss recognition. Therefore, findings from these literatures suggest that CEO overconfidence may have a negative influence on the performance of financial and investment policies and, impact the overall well-being of firms.

However, contradicting this line of findings, other scholars argue that CEOs overconfidence is associated with value enhancing financing and investment decisions. Camerer and Lovallo (1999) argue that the level of overconfidence is stronger among highly skilled CEOs. This suggests that overconfident CEOs make bold corporate decisions by virtue of their better ability and higher skills. Confirming Camerer and Lovallo (1999), Goel and Thakor (2008) show that under the value-maximizing corporate governance, overconfident managers are more likely to be promoted to the position of CEO which essentially suggests that boards believe these CEOs

would increase firm value and deter probability of bankruptcy. On a similar note, Galasso and Simcoe (2011) find that in competitive industries, overconfident CEOs are more likely to pursue innovation. They find a positive association between overconfidence and citation-weighted patent count. Calantone, Cavusgil and Zhao (2002) show that firm innovation is positively associated with firm performance. More recently, Phua, Tham and Wei (2018) find that overconfident CEOs hold strong beliefs about the prospects of the firms they run and their belief increase probability of greater and longer relationship-specific commitments and investments by suppliers. Contrary to the other stream, this stream of literature suggests that overconfident CEOs are more able than other groups of CEOs in terms of value creation and firm prosperity. Therefore, all these findings lead to the prediction that overconfident CEOs are less likely to be associated with probability of bankruptcy.

2.2. CEO overconfidence and firm financing decisions

While investigating the impact of CEO overconfidence on bankruptcy, one may argue that overconfident CEOs' selection of financing their firm is one of the most important factors in influencing probability of bankruptcy. Although Modigliani and Miller (1958) argue that capital structure is irrelevant for firm value under certain conditions, it is widely recognized that by relaxing the assumptions of efficient market and the independence of firm cash flow from firm financial policies, capital structure becomes relevant in determining firm value. Though these assumptions generally relate to firm characteristics, such as firm size, growth opportunities, collateral value of assets and profitability, Titman and Wessels (1988) show that debt level choices of firms are associated with the nature of business. Recently, Hovakimian (2006) show that the empirical effects of these characteristics are mixed. The finance literature focuses mainly on the impact of firm characteristics on capital structure choices, and the findings on the effects of CEO

overconfidence on firms' financing decisions is contradictory. For instance, Shefrin (2001) postulates that overconfident managers may choose high-debt capital structure and undermine probability of bankruptcy. Similarly, Hackbarth (2008) show that overconfident CEO choose high debt level and issue new debt more often. However, Hackbarth (2008) argues that because of high debt level, these CEOs reduce fund diversion which, in turn, reduces agency conflicts and increase firm value. Deshmukh *et al.* (2013) show that overconfident CEOs view external financing costly and therefore, reduce the amount of dividend to build financial slack to use for future investment needs. These findings suggest that this group of CEOs are more risk-averse in terms of their financing policies. Therefore, based on this strand of literature, we argue that overconfident CEOs are less likely to be associated with probability of bankruptcy, whereas diffident CEOs are more likely to be associated with probability of bankruptcy.

2.3. Firm investment policies

While we test whether firms run by overconfident CEOs are less likely to file for bankruptcy, one may argue that overconfident CEOs increase the riskiness of firms as shown by previous research. For example, Malmendier and Tate (2005) document that overconfident CEOs increase the insensitivity of investment spending to internal cash flow. Malmendier and Tate (2008) also argue that overconfident CEOs are more likely to engage in value-destroying acquisition. Kim, Wang and Zhang (2016) show that these CEOs are more likely to be associated with future stock price crash risk. Since, overconfident CEOs overestimate their ability to avoid negative events and underestimate the risk associated with excess borrowing (Kallunki and Pyykkö 2013), they are more likely to make mistakes in making critical business decisions (Kilborn 2005; Anderloni and Vandone 2011). Therefore, this line of literature suggests that overconfident CEOs are more prone to increase the likelihood of bankruptcy by adopting unwise investment policies.

However, another stream of literature argues that overconfidence may be beneficial to firm value by investing more in innovation and achieve more innovative success (Hirshleifer *et al.* 2012) and hence are able to gain higher citation-weighted patent count (Galasso and Simcoe 2011).

To resolve the conflicting findings of previous literature on the relation between CEO overconfidence and firm financial as well as investment policies, we argue that if the rewards of the decisions taken by overconfident CEOs offset the negative effects of those decisions, then overconfident CEOs are less likely to be associated with probability of bankruptcy. On the other hand, since diffident CEOs are less likely to make bold corporate decisions which may improve firm prosperity, this group of CEOs are relatively imprudent in exploiting profitable financial and investment opportunities. Therefore, in the presence of unexpected events, firms led by diffident CEOs are more likely to be caught off guard and as a result, are more likely to be associated with bankruptcy.

3. Empirical Analysis

3.1. Measure of CEO overconfidence

To test our main prediction, we use CEO compensation data in Execucomp database between 1992 and 2018. We follow Campbell *et al.* (2011) to use an extended version of stock-based measure of optimism as estimated by Malmendier and Tate (2005) and Malmendier, Tate and Yan (2007). Accordingly, overconfident CEOs are those who hold options deep in the money. Campbell *et al.* (2011) further classify CEOs into three categories – over, moderate, and low. Malmendier and Tate (2005) defines CEOs are overconfident if CEOs hold options that are more than 67% in the money. That is, the price of the stocks exceeds the exercise price by more than 67%. They use 67% by calibrating the model of Hall and Murphy (2002). Campbell *et al.* (2011) choose a higher level of cutoff to identify overconfident CEOs. Specifically, according to them

overconfident CEOs are those holding stock options that are more than 100% in the money. They argue that since the 67% cutoff as used by Malmendier and Tate (2005) identify confident managers, the 100% should identify over-confident managers. Though, we assign overconfident classification beginning with the first time CEOs hold stock options that are more than 100% in the money, results are similar even when we classify CEOs as overconfident if they display this behavior only in the second time. On the other hand, low or diffident managers are those holding stock options that are 30% or less in the money. These CEOs do not hold options that are more than 30% in the money. The remaining CEOs who do not fall in either of the two categories are classified as moderately confident CEOs. That is, CEOs who hold options that are between 30% and 100% in the money are considered moderately confident CEOs.

The option moneyness is also calculated by following Campbell *et al.* (2011). Specifically, following the approximation method of Core and Guay (2002) we calculate the average exercise price of aggregated options. The realizable value per option is the total realizable value of the exercisable options (ExecuComp variable OPT_UNEX_EXER_EST_VAL) divided by the number of exercisable options (OPT_UNEX_EXER_NUM). We subtract this value from the stock price at the fiscal year end (PRCC_F) to calculate estimated average exercise price. We then calculate the average percent moneyness of options by dividing the realizable value of one option by the estimated average exercise price. Following Campbell *et al.* (2011) we also use only exercisable options (OPT_UNEX_EXER_EST_VAL and OPT_UNEX_EXER_NUM).

On the other hand, for categorizing low confident or diffident CEOs, we compute the realized value of each option by dividing the total value realized from exercising stock options (OPT_EXER_VAL) by the number of options exercised (OPT_EXER_NUM). We calculate the estimated average exercise price by subtracting the realized value of each option from the stock

price at the end of the fiscal year (PRCC_F). We calculate the moneyness of the exercised options by dividing the value realized by selling each option by the estimated average exercise price. Following the method described previously, we calculate the moneyness of the unexercised but exercisable options. We classify CEOs as low confident when they exhibit this behavior the first time. We find similar results even if we classify CEOs as low confident when they exhibit the option exercise behavior only in the second time.

3.2. Bankruptcy score

Predicting corporate bankruptcies based on empirical analyses has attracted scholars for decades, because corporate bankruptcies impact not only the shareholders but also non-financial stakeholders. Since the seminal paper of Beaver (1966), scholars have focused on bankruptcy prediction models that can be divided under three categories: a) the static model based on accounting information (Altman 1968), b) the contingency model as derived by Vassalou and Xing (2004) (this model focuses on option pricing theory to predict corporate bankruptcy), and c) the hazard model that determines bankruptcy risk at any point of time based on dynamic information from the previous period. In this paper, we follow Shumway (2001) to determine bankruptcy scores following the discrete hazard model. Following this model, the higher the score, the higher is probability of bankruptcy. We assign a value of 1 to all the bankruptcy scores that belong to the top quartile. All the other scores are assigned a value of zero. The model used by Shumway (2001) is comparatively superior to other static models because hazard model takes into account the time-varying covariates, period at risk and the selection bias. Bauer and Agarwal (2014) also show that the hazard models have the highest predictive power.

According to Shumway (2001), with a logit model, each year in which a firm survives is included in the logit program “sample” as a firm that did not fail. When a firm goes bankrupt, it

contributes only one failure observation to the logit model. Following Shumway, we also include time-varying covariates by using firm-level annual data for its firm-year observations. Since the likelihood function is the same for the logit and hazard model, they have the same asymptotic variance-covariance matrix (Amemiya 1985). As the test statistics produced by logit model are incorrect because of the assumption that the independent assumptions used to estimate the model is the number of firm-year data, the sample size is adjusted to adjust for the lack of independence between firm-year observations. According to Shumway (2001) hazard model, each firm's life is one observation. Thus, the correct value to calculate the test statistics is the number of firms in the data.⁵

We include several control variables following previous literature. Specifically, we include firm size, profitability, leverage, market-to-book and cash holdings. Following Shumway (2001) we include past excess return. We also include three CEO characteristics such as tenure, duality (a dummy variable that takes a value of 1 if a CEO is also the chairman of the board, and zero otherwise), and whether a CEO is hired from outside (a dummy variable takes value of 1 if a CEO is hired from outside, zero otherwise).

3.2. Sample and data

The data for this study comes from several sources. We use S&P Compustat and Center for Research in Security Prices (CRSP) databases to obtain financial information and other firm-level attributes to calculate excess return. We exclude financial and utility firms from our benchmark sample. The final sample for our baseline analysis consists of 3207 firms with 19,408 firm-year observations from 1992 to 2018.

⁵ For a detail description of the dynamic hazard model, please see Shumway, T. (2001). Forecasting bankruptcy more accurately: A simple hazard model. *The journal of business*, 74(1), 101-124.

We conduct a battery of sub-sample and robustness tests. The additional data for these tests come from the Institutional holding data of Thomson Reuters and ISS (formerly, RiskMetrics) board size database.

4. Empirical Results

4.1 Summary Statistics

Table 3.1 presents the descriptive statistics for the variables used in this study. Panel A shows that around 20.5% of the total observations belong to overconfident CEOs, followed by 12% and 67.5% observations belonging to moderately confident and low confident (diffident) CEOs, respectively. The statistically significant mean difference (in Panel B) between firms with high and low probability of bankruptcy for each level of CEO confidence indicates that overconfident and moderately confident CEOs are less likely to be associated with bankruptcy, whereas, diffident CEOs are more likely to be associated with bankruptcy. Panel A also indicates that 37.5% of CEOs also serve as chairman of the board. Research shows that firms that are led by dual leadership generally perform worse than firms that split CEO and chairman position (Brickley, Coles and Jarrell 1997). Therefore, in the context of bankruptcy, we argue that the high percentage of dual CEOs may have a positive impact on bankruptcy. The high statistical significance (at 1% level) of mean difference of outsider CEOs between bankrupt and non-bankrupt (in Panel B) companies, and corresponding t -value support our argument. The univariate analysis in Panel B also indicate statistically significant influence of board size, board composition and institutional holding on our analyses of various confidence level on probability of bankruptcy.

[Insert Table 3.1 about here]

4.2 Main regression results

In Table 3.2, we present the results of the baseline regressions on the relationship between CEO confidence and probability of bankruptcy. The dependent variable is a dummy variable that takes a value of 1 if the bankruptcy score of a company following Shumway (2001) belongs to the upper quartile of all bankruptcy scores, and zero otherwise. Since we use logistic regressions, the coefficients derived from the regressions are log odds ratios. We transform the log odds ratios to probabilities with the natural exponential function, i.e., e^c where e is the mathematical constant (2.71828) and c is the coefficients derived from the logistic regressions. Therefore, the effect of one-unit change in the coefficient of any independent variable on probability of bankruptcy is calculated as follows: $(e^c - 1) * 100$.

The first model shows overconfidence has negative and statistically significant association with probability of bankruptcy. In economic terms, a 1% increase in CEO overconfidence reduces probability of bankruptcy by 9.9%. The results also show that CEO tenure is negatively associated with bankruptcy. Column (1) indicates that a 1% increase in firm profit decreases probability of bankruptcy by 19.88%, whereas a 1% increase in firm leverage increases probability of bankruptcy by around 375%. According to Admati, DeMarzo, Hellwig and Pfleiderer (2018), since leverage ratchet effect is always in place, creating asymmetric forces in leverage adjustments, firms in distress are more likely to resist leverage reduction. Therefore, we may conclude that for distressed firms, higher level of leverage may sharply increase probability of bankruptcy. Consistent with previous literature (Thornhill and Amit 2003), we also find a positive relation between firm size and probability of bankruptcy. Furthermore, the regression results indicate a negative association of market-to-book ration, firm cash holding, and abnormal return with the likelihood of bankruptcy. According to Miller (1991), long-tenured CEOs tend to be reluctant to change their

policies. They argue that if long-tenured CEOs do not change policies in accordance with environmental changes, then they may increase the level of firm distress. However, Henderson, Miller and Hambrick (2006) argue that this relationship is industry specific and dynamic industries experience the negative effects of CEO life cycles more rapidly than stable industries. In contrast with Miller (1991), the negative relation suggests that, in general, long-tenured CEOs are more likely to be flexible towards their policies to save their firms from potential bankruptcies. Specifically, the result in column (1) suggests that a 1 % increase in CEO tenure reduces probability of bankruptcy by 6.2% for overconfident CEOs. We also find that CEO duality and CEOs who are hired from outside are positively associated with probability of bankruptcy. Though Chen, Lin and Yi (2008) find no significant relation between CEO duality and firm performance, our results indicate that duality is positively related to bankruptcy. This suggests that when CEOs are given more power by way of dual leadership, the likelihood of bankruptcy increases. Literature on the effects of hiring outsider CEO suggests that the high rate of turnover of outsider CEO is caused by their inability to meet the expectations of the board of directors (Kotter 1982; Gabarro 1987). This suggests that hiring CEOs from outside may decrease firm performance. Also, Karaevli (2007) and Zhang and Rajagopalan (2010) suggest that strategies undertaken by outsider CEOs adversely affect the performance – both in the early and later year of succession. Consistent with these previous findings, the results of our analysis suggest that outsider CEOs are positively associated with bankruptcy.

Column (2) shows the relation between moderate level of CEO confidence and probability of bankruptcy. The results indicate that a 1% change in the confidence level of moderately confident CEOs decreases probability of bankruptcy by 6.5%. As expected, the results support our hypothesis that high level of CEO confidence is more effective in reducing the likelihood of

bankruptcy compared to moderate level of confidence. Finally, column (3) shows the effect of diffident CEOs on probability of bankruptcy. The results indicate a positive relation between the two. In economic terms, a 1% change in the confidence level of diffident CEOs is associated with 12% increase in probability of bankruptcy of the companies they lead. Overall, the findings are consistent with our argument that different levels of CEO confidence affect probability of bankruptcy differently.

[Insert Table 3.2 about here]

4.3 Robustness test: effect of board size and board independence

Since board of directors represent shareholders, the board acts as a governing body that protects the interest on the shareholders. Literature shows that board size affects not only firm risk-taking behavior, but also firm performance. Agency theory predicts that managers are reluctant to undertake risky projects since they want to protect their personal welfare (Fama 1980; Holmström 1999). Bertrand and Mullainathan (2003) establish that managers are indeed reluctant to take risk. However, CEO risk-taking initiatives can be significantly influenced by the level of confidence. Hirshleifer *et al.* (2012) find that overconfident CEOs invest more risky projects, such as R&D and therefore, firms they run obtain more patents and patent citations.

Research on the impact of board size on firm risk-taking indicates that board size is negatively associated with firm risk-taking. Jensen (1993) argues that a board with more than seven to eight members are likely to be ineffective. Yermack (1996), based on US firms, finds that large board size is associated with lower firm value, measured by Tobin's Q. This is because of the cost associated with the lack of coordination and communication as well as director's free-riding cost. Therefore, we argue that board size is likely to increase probability of bankruptcy. However, when analyzing the impact of board size in detail we find various literature which claims factors other

than board size impact probability of bankruptcy. For example: Fich and Slezak (2008) argue the effectiveness of governance mechanism of the board may be dependent on the composition of the board and firm financial health – smaller boards are more effective when firms are in a better financial situation while larger boards are more effective in distress, since board members can bring strategic alliances which could be effective for distressed firms in avoiding bankruptcies. They find that distressed firms with smaller boards are more effective in avoiding bankruptcy since they are more likely to make necessary adjustments without much resistance. In analyzing board compositions, Fich and Slezak (2008) also argue that the governance mechanism induced by insider directors are more effective when a firm is in distress as insiders have a higher risk of losing their jobs which motivates them to take effective measures to avoid bankruptcy, while outsider directors are more effective when a firm is financially sound as the outsiders induce effective governance during such periods. Therefore, it would be worthwhile to investigate how the presence of board size and board composition in our analysis impact the relationship between different levels of CEO confidence and probability of bankruptcy.

The results presented in Table 3.3 indicate that in all three models, there is a strong positive relation between board size and probability of bankruptcy. In economic terms, a 1% increase in board size increases probability of bankruptcy by 18.6% in case of overconfident CEOs. Table 3.3 also indicates that for a 1% increase in overconfidence, probability of bankruptcy further decreases by $(19.6 - 9.9) \% = 9.7\%$, (where 9.9% is the decrease in probability of bankruptcy for 1% increase in CEO overconfidence following Table 3.2) whereas for diffident CEOs, the effect becomes statistically insignificant. These results indicate that in the presence of large boards, the negative relation between CEO confidence and probability of bankruptcy further strengthens. When we interact different level of confidence with board size, we find that the negative effect of

overconfidence subject to board size persists with 1% statistical significance. In line with previous literature which connects excessive confidence and unrealistically optimistic behavior to narcissism (Rosenthal and Pittinsky 2006), we argue that when overconfident CEOs have more power (see Fast, Sivanathan, Mayer and Galinsky (2012)) in the selection process of directors, the CEOs are likely to recruit directors who exhibit similar trait of overconfidence. Following Zhu and Chen (2015) we also argue that such directors are more supportive of the decisions taken by overconfident CEOs, and as a result, firms under the helm of overconfident CEOs are exposed to lower probability of bankruptcy. The same trend can be noticed for firms run by moderately confident CEOs.

[Insert Table 3.3 about here]

In Table 3.4 we show the effects of higher and lower proportion of insider directors in the board. Here we divide the sample based on the median percentage of insider directors. The results indicate that in the presence of higher percentage of insider directors, probability of bankruptcy is relatively higher for overconfident CEOs. Specifically, when comparing columns (1) and (4) we conclude that in the presence of lower percentage of insider directors, the negative relationship between CEO overconfidence and probability of bankruptcy is stronger than the negative relationship between the two when there is higher percentage of insider directors. In economic terms, when the percentage of insider directors is higher than the median value, a 1% percentage increase in CEO overconfidence reduces probability of bankruptcy by 13.1%, whereas when there is a lower percentage of insider directors, probability of bankruptcy decreases by 16.2% with 1% increase in CEO overconfidence. On the other hand, comparing columns (3) and (6), we find that for diffident CEOs, probability of bankruptcy increases by 9.4 % (from 10.5 to 19.9) when there is a lower percentage insiders than the median value, compared to when there is a higher

percentage of insider directors. In other words, these results indicate that overconfidence is more effective in the presence of lower percentage of insider directors and less effective when there is higher percentage insider directors.

[Insert Table 3.4 about here]

To complement our previous finding, we conduct additional tests by dividing the sample based on median percentage of outsider directors. Literature claims that outsider directors are effective in monitoring firm investment policies (Bacon 1985; Byrd and Hickman 1992) and financial policies (Al-Najjar and Hussainey 2009). These studies show that outsider directors are more prudent and knowledgeable in policy determination and, therefore, they tend to increase shareholders wealth. Subsequently, some literature also suggests that the appointment of outsider directors has monitoring effects that aid to increase shareholders wealth. Based on a study from the banking industry, Brickley *et al.* (1997) find that outsider directors are likely to reduce the consumption of perquisites by management. Weisbach (1988) finds a positive association between the percentage of outsider director in the board and CEOs turnover following poor corporate performance. Rosenstein and Wyatt (1990) show that appointments of outsider director receive positive stock price reactions and, as a result, increase shareholders wealth. Therefore, the higher percentage of outsider board directors is expected to further reduce probability of bankruptcy. The results presented in Table 3.5 show that in firms with higher percentage of outsider directors than the median number, a 1% increase in CEO overconfidence is associated with a 18% decrease in probability of bankruptcy and the relation is statistically significant at 1% level. On the other hand, for firms with lower percentage of outsider directors, probability of bankruptcy decreases by 10.8% with a 10% level of statistical significance. For diffident CEOs, with higher percentage of outsider in the board the probability of bankruptcy increases further, whereas for lower percentage

of outsider in the board the relationship between diffident CEO and probability of bankruptcy becomes statistically insignificant. This indicates that the presence of outsider director in the board is harmful for shareholders when the firm is run by diffident CEOs.

[Insert Table 3.5 about here]

4.3 Robustness test: effect of institutional holdings

Literature on the relationship between institutional investment and corporate governance indicates that institutional shareholders increase the quality of corporate governance. Karpoff (2001) finds that institutional shareholder activism causes changes in governance structure by inducing increases in the number of independent directors on audit committee and by changing managerial compensation. However, the impact is negligible on share value and earnings. More recently, Chen, Harford and Li (2007) find that institutions with long-term corporate investments increase monitoring and they can influence to reverse bad managerial decisions. Literature also shows that the presence of institutional holdings impacts firm operating performance and firm value. McConnell and Servaes (1990) find a positive relation between institutional holding and Tobin's Q. However, Woidtke (2002) shows that this positive association applies only to ownership by pension funds. Goel and Thakor (2008) find that under the "value-maximizing" corporate governance systems, overconfident managers are likely to be promoted to the position of CEOs. However, little scholarly attention has been given to identify the impact of institutional holdings on probability of bankruptcy in the presence of different levels of CEO confidence.

Since institutional investors are viewed as critical for improving firm operating performance through increased monitoring and are rewarded based on their short-term performance, they tend to focus more on short-term returns (Baysinger, Kosnik and Turk 1991; Aguilera, Rupp, Williams and Ganapathi 2007). Consequently, institutional investors support

investments that are expected to be associated with immediate profits, such as mergers and acquisitions (Graves 1988). Since the size of institutional ownership is positively associated with firm-specific risk and firm value (Hutchinson, Seamer and Chapple 2015), we argue that overconfident CEOs engage in more effective corporate decisions in the presence of institutional investors that further reduce probability of bankruptcy in comparison to moderately confident CEOs. Hutchinson *et al.* (2015) also show that institutional holdings increase firms' comprehensive risk-management, implying that the presence of institutional investors may create a balance between risk taking and risk management by CEOs which, in turn, may increase firm value. On the other hand, based on previous findings, we argue that since diffident CEOs are unable to take effective decisions to increase firm value, their adopted policies work against the interests of institutional investors. As a result, the conflict of interest between diffident CEOs and institutional investors, who are more focused on short-term return results, may further exacerbate probability of bankruptcy.

The results presented in Table 3.6 show that for firms ran by overconfident CEOs with institutional investors holdings, probability of bankruptcy further drops relative to the baseline model in Table 3.2. In economic terms, the presence of institutional investors further reduces the probability of bankruptcy by $(33.2 - 9.9) = 23.3\%$ for every 1% increase in the level of overconfidence. For firms under the helm of diffident CEOs, probability of bankruptcy further increases by $(22.4 - 12) = 10.4\%$. Though the signs of the incremental effects of institutional holding on different level of CEO confidence remain consistent, the coefficients remain statistically insignificant.

[Insert Table 3.6 about here]

However, the stronger negative effect of overconfidence on bankruptcy, and stronger positive effect of low confidence on bankruptcy in the presence of institutional investors may indicate that the presence of these investors may augment the impact of different level of confidence on the likelihood of bankruptcy. Studies show that due to high costs associated with the monitoring of managers, only large shareholders, such as institutional investors, can have the incentive to oversee managerial activities (Grossman and Hart 1980). Similar to this finding, Shleifer and Vishny (1986) also show that large institutional holders have greater incentive, resources, and ability to monitor, influence and discipline managers than directors, who may have small investment in the firm. Other studies also show that in the presence of institutional investors, managers focus more on firm performance and less on self-serving behavior. Therefore, to complement our analysis of the impact of institutional investors on the relation between CEO confidence and probability of bankruptcy, we divide the sample based on the median percentage of institutional holdings and re-run our regressions. These results are presented in Table 3.7. Comparing column (1) and column (4), consistent with our expectation, we find the inverse relation between overconfidence is much stronger in firms with higher (major) institutional holdings than in firms with lower (minor) institutional holdings. We also find that a stronger positive relation between diffident CEOs and probability of bankruptcy in firms with high institutional holdings than in firms with low institutional holdings (columns (3) and (6), respectively). Overall, these patterns indicate the firms ran by overconfident CEOs benefit more by their exposure to the presence of higher institutional holdings.

[Insert Table 3.7 about here]

4.4 Robustness test: effect of short-term debt

Next, we examine the impact of CEO confidence on probability of bankruptcy in the presence of high versus low level short-term debt financing. According to Myers (1984) pecking-order of financing, firms prefer to use internal financing resources before issuing debt and equity. That is, when firms need to raise external financing, their first choice is to issue debt whereas, they issue equity as their last resort. Malmendier *et al.* (2007) find that overconfident CEOs are likely to show debt conservatism, that is, they are likely to issue lower level of debt relative to the tax benefit associated with the issuance of debt. Other scholarly works also confirm the direct relation between managerial perception and firm financing decisions. Hackbarth (2008) argue that overconfident managers believe that their firms are more profitable and less risky, and as a result prefer higher level of debt and issue new debt more often than unbiased managers. Complementing these findings, Malmendier *et al.* (2011) show that overconfident CEOs are prone to issue more debt over equity because they believe that equity is undervalued more than debt. More recently, Huang *et al.* (2016) has identified a positive relation between managerial overconfidence and issuance of short-term debt. They argue that since overconfident managers believe that they have more positive private information about their firms' prospects relative to the market, all the securities issued by firms are mispriced and this mispricing is more severe for long-term debt than for short-term debt. As a result, overconfident managers are more likely to prefer short-term debt since this type of debt can be refinanced at a lower cost in the presence of positive news. However, short-term debt financing bears a high financing cost. Therefore, we argue that the effect of the degree of CEO confidence may have differential impact on probability of bankruptcy, since high and low level of short-term financing – induced by different level of confidence – put different degree of financial obligation on firms. To assess the potential impact of the degree of CEO

confidence on probability of bankruptcy conditional on high level relative to low level of short-term debt, we re-run our analysis by dividing the sample into high versus low short-term debt relative to the median value of short-term debt and repost the results in Table 3.8.

The results indicate that high level of short-term debt lead to a lower probability of bankruptcy in firms ran by CEOs with high overconfidence. However, in the case of firms with moderately confident CEOs, higher level of short-term debt leads to higher probability of bankruptcy. In economic terms, a 1% increase in overconfidence reduces probability of bankruptcy by 21.9% in the presence of high level of short-term debt. On the other hand, a 1% increase in moderate confidence increases probability of bankruptcy by 17.4% for firms with high level of short-term debt. The results demonstrate that overconfident CEOs profitably exploit the benefits of high levels of the short-term debt financing option and can successfully reduce probability of bankruptcy. The positive and significant association between moderate levels of managerial confidence and probability of bankruptcy may suggest that the first-best level of investment chosen by this group of CEOs, as documented by Campbell et al. (2011), may not be effective in increasing shareholders' value, rather such investments tend to destroy firm value.

[Insert Table 3.8 about here]

4.5 Robustness test: effect of free cash flow

We then examine the effect of CEO overconfidence on the probability of bankruptcy conditional on high and low level of free cash flow. Free cash flow is defined as the cash flow in excess of what is required to finance normal investment activities. Jensen (1986) argues that agency conflict between shareholders and managers is exacerbated when firms hold substantial free cash flow because excess cash offers managers the opportunity to extract rents without subjecting themselves to the monitoring associated with external financing, which allows

managers to engage in negative net present value (NPV) projects. Hubbard (1997) document a positive relation between investment expenditures and cash flow. Richardson (2006) interprets this relation from two different perspectives: a) the agency problem and b) capital market imperfection. On the one hand, according to Jensen (1986), in the presence of free cash flow managers are more likely to be involved in value destroying mergers and takeovers, instead of returning the money by stock repurchases or permanent increases in the amount of dividend. Therefore, such free cash flow gives rise to agency problems. On the other hand, Fazzari, Hubbard and Petersen (1988) argue that in the presence of capital market imperfections, free cash flow generates investment opportunities. Since overconfident CEOs believe that their firms are undervalued, in the presence of free cash flow, they may engage in higher level of investment activities. Camerer and Lovo (1999) suggest that overconfident CEOs are likely to be high ability managers.

We argue that overconfident CEOs are more prudent in utilizing internally generated free cash flow and, thus reduce probability of bankruptcy by increasing firm value. The results presented in Table 3.9 indicate that in the presence of high free cash flow, overconfident CEOs are negatively and significantly associated with probability of bankruptcy, whereas moderately confident CEOs are positively associated with bankruptcy. Overconfident CEOs, because of their high ability, can identify profitable investment opportunities more frequently than moderate and low confident CEO in improving firm value and reducing probability of bankruptcy. Moderately confident CEOs, on the other hand, are less likely to identify profitable investments and, therefore, they are less likely to increase firm value, and as such increasing probability of bankruptcy. Perhaps moderately confident CEOs, expecting that they would be able to generate substantial returns, invest in value-destroying opportunities. As a result, firms led by such CEOs suffer from increased bankruptcy risk. Table 3.9 also indicates statistically insignificant association between

low confidence CEOs and probability of bankruptcy in the presence of high and low levels of free cash flow. This may indicate that low confident CEOs are likely to be indifferent towards utilizing internally generated free cash flows. Overall, the results reveal that though, in general, free cash flow may give rise to agency problems and may induce managers to be involved in value destroying investments, over-confident CEOs are not involved in such value destroying activities.

[Insert Table 3.9 about here]

4.6 Robustness test: effect of credit rating

In this section we examine the impact of various CEO confidence level on probability of bankruptcy for firms with and without credit ratings. Previous research (Hand, Holthausen and Leftwich (1992); Ederington and Goh (1998)), shows that investors penalize firm stock in response to bond rating downgrades. Odders-White and Ready (2006) find that the presence of credit rating reduces uncertainty about firm value and there is a positive relation between credit rating and equity liquidation. More recently, Kuang and Qin (2013) show that rating downgrades in the immediate prior year reduces CEO vega (sensitivity of managerial wealth to stock return volatility) of newly granted option in the current year. In short, lower credit ratings decrease CEO risk-taking. Based on a sample of bank data collected between 1993 to 2006, Niu (2010) find that CEO overconfidence is positively associated with risk taking. Therefore, for firms with credit rating and with overconfident CEOs, it may be expected that these CEOs will be involved in higher level of risk-taking initiatives. On the other hand, firms with no credit rating and overconfident CEOs may be involved in lower level of risk-taking activities. Since the equity market has already accounted for the positive effect of credit rating on stock prices, the effect of CEO overconfidence can be expected to have a higher impact on firm value for firms with no credit rating than for firms with credit rating. Hence, we may expect that for firms with no credit rating, higher level of

overconfidence is likely to reduce probability of bankruptcy more than the probability of bankruptcy for firms with credit rating.

The results of the regressions are presented in Table 3.10. Columns (1) and (2) show that for 1% increase in CEO overconfidence, probabilities of bankruptcy decrease by 7.2% and 15.3% for firms with and without credit ratings, respectively. The regressions results for firms run by moderately confident CEOs indicate a statistically insignificant inverse relationship between these CEOs and the likelihood of bankruptcy. On the other hand, for firms with low confident CEOs, probability of bankruptcy increases by 9.1% and 14.9%, respectively, for firms with and without credit ratings. Therefore, firms managed by diffident CEOs and with no credit rating appear to experience a higher probability of bankruptcy compared to firms with credit rating. This higher probability of bankruptcy may be caused by the combined effect of lack of risk-taking initiatives by the low confidence CEOs and access to external capital.

[Insert Table 3.10 about here]

5. Conclusion

This study examines whether CEO overconfidence is likely to reduce probability of bankruptcy. The results of our statistical analyses indicate that CEO overconfidence is not necessarily detrimental to firm fortunes and it does not predict loss of firm value. Using option holdings and option exercise behavior of CEOs as a proxy of CEO overconfidence, we document that overconfident CEOs are likely to reduce probability of bankruptcy, whereas diffident CEOs are likely to increase probability of bankruptcy.

Much of the existing evidence suggests that overconfident CEOs make unjustified investments, corporate and financing decisions. However, the effect of hubris may not be as straight-forward as previously identified. A key contribution of this study is the discovery that

firms run by highly overconfident CEOs are least likely to be exposed to bankruptcy in comparison to firms run by diffident CEOs. Further analyses also reveal that though corporate board size positively associated with bankruptcy, the positive effect become significant in the presence of overconfident CEOs. Focusing on the proportion of insider and outsider directors in the corporate boards, we identify a stronger negative effect of overconfidence on bankruptcy for firms with lower percentage of insider directors and higher percentage of outsider director. Confirming the findings of previous literature regarding the governance effects of institutional investors, we find that higher level of stock holding by institutions amplifies the negative association between overconfidence and bankruptcy probability.

Further analyses by focusing on the effect of short-term debt indicates that overconfident CEOs are far more effective in exploiting the benefits of short-term debt, and as a results this group of CEOs further reduces the likelihood of bankruptcy when they raise more money on a short-term basis. We also find that under the condition of high agency cost, probability of bankruptcy for firms managed by overconfident CEOs further decreases. Finally, we find that for firms without credit rating, the inverse effect of CEO overconfidence on probability of bankruptcy is more pronounced than that for firms with credit rating.

The study provides an alternative interpretation about bankruptcy risk and financial distress. Unlike previous studies that blamed overconfidence for being harmful to firm fortunes, our study shows a positive aspect of this dimension of CEO trait. Our results also have strong implications for the design of corporate boards and for financial stakeholders. Future studies may focus on how the design of corporate boards in the presence of overconfident CEOs may affect various corporate policies and performance.

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Table 3.1: Descriptive statistics

Panel A presents summary statistics on the independent and dependent variables employed in this study from 1992 to 2018. Panel B table reports the mean difference and the *t*-values of the *t*-tests for the variables belonging to the classification Bankruptcy = 1 and Bankruptcy = 0. The dummy variable *Bankruptcy* takes a value of 1 for all the firm-year observation in which the bankruptcy score following Shumway (2001) hazard model belong to the top quartile, and zero otherwise. ***, **, and * denote significant at 1%, 5%, and 10% level, respectively.

Panel A: Summary statistics

	N	Mean	STD	Q1	Median	Q3
Over Confidence	5960	0.205	0.404	0	0	0
Moderate Confidence	3472	0.120	0.324	0	0	0
Low Confidence	19613	0.675	0.468	0	1	1
Profit	28914	0.035	0.106	0.009	0.043	0.083
Leverage	28914	0.143	0.186	0	0.032	0.257
Size	28914	7.581	1.796	6.282	7.429	8.743
Market-to-Book	27782	1.990	1.360	1.155	1.533	2.243
Cash	28914	0.141	0.170	0.022	0.071	0.199
Abnormal Return	22063	0.006	0.105	-0.050	0.002	0.056
Log (CEO Tenure)	26320	1.897	0.880	1.386	1.946	2.565
CEO Duality	29045	0.375	0.484	0	0	1
Outsider Dummy	29045	0.174	0.379	0	0	0
Board Size	11420	2.155	0.263	1.946	2.197	2.303
Insider Dir. Percentage	11420	0.704	0.169	0.6	0.75	0.833
Outside Dir. Percentage	11420	0.296	0.169	0.167	0.250	0.400
Institutional Holding	13677	0.570	0.171	0.473	0.586	0.685

Panel B: Univariate analysis

	Bankruptcy = 1	Bankruptcy = 0	Mean Difference	t-Value
	Mean	Mean		
Over Confidence	0.176	0.215	-0.038***	7.28
Moderate Confidence	0.112	0.122	-0.011**	2.47
Low Confidence	0.712	0.663	0.049***	7.90
Profit	0.011	0.050	-0.061***	39.89
Leverage	0.173	0.133	0.041***	14.95
Size	8.155	7.389	0.766***	30.95
Market-to-Book	1.499	2.151	-0.652***	44.29
Cash	0.106	0.153	-0.047***	22.53
Abnormal Return	-0.017	0.018	-0.034***	22.45
Log (CEO Tenure)	1.859	1.910	-0.052***	4.17
CEO Duality	0.398	0.368	0.030***	4.57
Outsider Dummy	0.187	0.169	0.017***	3.29
Board Size	2.187	2.146	0.041***	7.18
Insider Dir. Percentage	0.710	0.703	0.007*	1.65
Outside Dir. Percentage	0.291	0.297	-0.007*	1.65
Institutional Holding	0.557	0.573	-0.016***	4.31

Table 3.2: Probit analysis on the relation of different levels of CEO confidence and the probability of bankruptcy.

The table presents probit regression results of how CEO overconfidence, moderate confidence and low confidence, estimated by following Campbell et al. 2011, impact the probability of bankruptcy. The dependent variable is a dummy variable that takes a value of 1 if the bankruptcy scores following Shumway (2001) belong to top quartile, and 0 otherwise. *Profit* refers to net income scaled by total assets. *Leverage* refers to total debt scaled by total assets. *Size* refers to the log value of total assets. *Market-to-Book* is the ratio of total assets minus book value of equity plus market value of equity scaled by total assets. *Cash* is the ratio of cash and cash equivalent to total assets. *Abnormal Return* is the return of the firm in year t minus the market return of the last 12 months of fiscal period. *log (CEO Tenure)* refers to the log value of the number of years a CEO has in office. *CEO Duality* is a dummy variable that takes a value of 1 if a CEO also serves as the chairman of the board, and 0 otherwise. *Outsider Dummy* is a dummy variable that takes a value of 1 if a CEO is hired from outside, and 0 otherwise. We also report the R-square value, and the asterisks *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Variables	DV = Bankruptcy Dummy		
	(1)	(2)	(3)
Over Confidence	-0.099*** (14.82)		
Moderate Confidence		-0.065** (4.33)	
Low Confidence			0.120*** (23.44)
Profit	-0.198*** (1746.06)	-0.243*** (1766.27)	-0.210*** (1730.67)
Leverage	3.757*** (569.50)	3.757*** (569.77)	3.759*** (569.44)
Size	0.215*** (877.15)	0.214*** (866.71)	0.218*** (886.57)
Market-to-Book	-0.110*** (80.26)	-0.115*** (89.39)	-0.109*** (78.38)
Cash	-0.620*** (136.31)	-0.617*** (134.86)	-0.620*** (136.32)
Abnormal Return	-0.928*** (547.93)	-0.927*** (539.14)	-0.927*** (542.94)
Log (CEO Tenure)	-0.062*** (25.66)	-0.064*** (27.25)	-0.061*** (24.88)
CEO Duality	0.184*** (56.10)	0.183*** (55.57)	0.184*** (55.65)
Outsider Dummy	0.196*** (33.46)	0.194*** (32.79)	0.192*** (32.18)
N	19408	19408	19408
Pseudo R-square	0.2679	0.2675	0.2682
Industry FF	Y	Y	Y
Year FE	Y	Y	Y

Table 3.3: Probit analysis on the relation of CEO confidence and the probability of bankruptcy, considering board size.

The table presents probit regression results of how CEO overconfidence, moderate confidence and low confidence, estimated by following Campbell et al. 2011, impact the probability of bankruptcy, considering the effect of board size. The dependent variable is a dummy variable that takes a value of 1 if the bankruptcy scores following Shumway (2001) belong to top quartile, and 0 otherwise. *Profit* refers to net income scaled by total assets. *Leverage* refers to total debt scaled by total assets. *Size* refers to the log value of total assets. *Market-to-Book* is the ratio of total assets minus book value of equity plus market value of equity scaled by total assets. *Cash* is the ratio of cash and cash equivalent to total assets. *Abnormal Return* is the return of the firm in year t minus the market return of the last 12 months of fiscal period. *log (CEO Tenure)* refers to the log value of the number of years a CEO has in office. *CEO Duality* is a dummy variable that takes a value of 1 if a CEO also serves as the chairman of the board, and 0 otherwise. *Outsider Dummy* is a dummy variable that takes a value of 1 if a CEO is hired from outside, and 0 otherwise. We also report the R-square value, and the asterisks *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Variables	DV = Bankruptcy Dummy		
	(1)	(2)	(3)
Over Confidence	-0.196** (4.59)		
Moderate Confidence		0.378 (1.76)	
Low Confidence			0.225 (0.87)
Board Size	0.104 (1.89)	0.172* (6.43)	0.188* (3.44)
Profit	-1.195*** (716.43)	-1.193*** (728.56)	-1.196*** (709.28)
Leverage	0.751*** (760.69)	0.750*** (754.77)	0.751*** (759.11)
Size	0.075*** (34.95)	0.074*** (34.1)	0.077*** (37.08)
Market-to-Book	-0.029* (2.82)	-0.021 (1.47)	-0.029* (2.87)
Cash	-4.561*** (92.56)	-4.611*** (92.49)	-4.622*** (92.34)
Abnormal Return	-1.376*** (421.32)	-1.377*** (417.4)	-1.379*** (417.25)
Log (CEO Tenure)	-0.104*** (21.98)	-0.109*** (24.26)	-0.102*** (21.56)
CEO Duality	0.222*** (68.57)	0.224*** (69.86)	0.221*** (67.65)
Outsider Dummy	0.115*** (7.76)	0.117*** (8.01)	0.114*** (7.59)
Over Confidence * Board Size	-0.224* (3.08)		
Moderate Confidence * Board Size		-0.406 (2.03)	
Low Confidence * Board Size			0.076 (0.25)
N	9677	9677	9677
Pseudo R-square	0.266	0.265	0.2659
Industry FF	Y	Y	Y
Year FE	Y	Y	Y

Table 3.4: Probit analysis on the relation of CEO confidence and probability of bankruptcy in firms with high vs low percentage of insider directors.

The table presents probit regression results of how CEO overconfidence, moderate confidence and low confidence, estimated by following Campbell et al. 2011, impact the probability of bankruptcy, in the presence of higher and lower percentage of insider directors compared to the median value. Insider Percentage is calculated by dividing the number of insider directors by the total number of directors. The dependent variable is a dummy variable that takes a value of 1 if the bankruptcy scores following Shumway (2001) belong to top quartile, and 0 otherwise. *Profit* refers to net income scaled by total assets. *Leverage* refers to total debt scaled by total assets. *Size* refers to the log value of total assets. *Market-to-Book* is the ratio of total assets minus book value of equity plus market value of equity scaled by total assets. *Cash* is the ratio of cash and cash equivalent to total assets. *Abnormal Return* is the return of the firm in year t minus the market return of the last 12 months of fiscal period. *log (CEO Tenure)* refers to the log value of the number of years a CEO has in office. *CEO Duality* is a dummy variable that takes a value of 1 if a CEO also serves as the chairman of the board, and 0 otherwise. *Outsider Dummy* is a dummy variable that takes a value of 1 if a CEO is hired from outside, and 0 otherwise. We also report the R-square value, and the asterisks *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Variables	DV = Bankruptcy Dummy					
	Insider Percentage \geq Median			Insider Percentage < Median		
	(1)	(2)	(3)	(4)	(5)	(6)
Over Confidence	-0.131** (6.48)			-0.162*** (8.02)		
Moderate Confidence		0.012 (0.04)			-0.098 (1.54)	
Low Confidence			0.105** (4.30)			0.199*** (10.97)
Profit	-0.223*** (373.12)	-0.209*** (376.04)	-0.235*** (368.46)	-0.197*** (348.93)	-0.164*** (354.58)	-0.125*** (346.74)
Leverage	34.945*** (523.60)	34.920*** (523.44)	34.888*** (523.37)	10.789*** (244.51)	10.532*** (241.40)	10.787*** (244.54)
Size	0.101*** (35.89)	0.098*** (33.81)	0.103*** (36.93)	0.133*** (38.84)	0.129*** (37.18)	0.136*** (40.44)
Market-to-Book	-0.096*** (12.25)	-0.084*** (9.53)	-0.093*** (11.63)	-0.028 (1.26)	-0.035 (1.99)	-0.027 (1.16)
Cash	-0.705*** (44.32)	-0.700*** (43.18)	-0.702*** (43.79)	-0.727*** (44.53)	-0.728*** (44.93)	-0.728*** (44.84)
Abnormal Return	-0.982*** (224.23)	-0.982*** (221.81)	-0.982*** (221.89)	-0.964*** (194.86)	-0.963*** (190.95)	-0.963*** (192.34)
Log (CEO Tenure)	-0.049* (2.97)	-0.056** (3.90)	-0.050* (3.08)	-0.135*** (26.98)	-0.137*** (27.66)	-0.134*** (26.69)
CEO Duality	0.266*** (23.67)	0.270*** (24.44)	0.264*** (23.49)	0.389*** (43.05)	0.387*** (42.85)	0.385*** (42.41)
Outsider Dummy	0.174** (5.34)	0.174** (5.37)	0.170** (5.14)	0.101 (2.30)	0.103 (2.40)	0.097 (2.15)
N	5156	5156	5156	4521	4521	4521
Pseudo R-square	0.2776	0.2767	0.2773	0.2606	0.2595	0.2610
Industry FF	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Table 3.5: Probit analysis on the relation of CEO confidence and probability of bankruptcy in firms with high and low percentage of outsider directors.

The table presents probit regression results of how CEO overconfidence, moderate confidence and low confidence, estimated by following Campbell et al. 2011, impact the probability of bankruptcy, in the presence of higher and lower percentage of outsider directors compared to the median value. Outsider Percentage is calculated by dividing the number of outsider directors by the total number of directors. The dependent variable is a dummy variable that takes a value of 1 if the bankruptcy scores following Shumway (2001) belong to top quartile, and 0 otherwise. *Profit* refers to net income scaled by total assets. *Leverage* refers to total debt scaled by total assets. *Size* refers to the log value of total assets. *Market-to-Book* is the ratio of total assets minus book value of equity plus market value of equity scaled by total assets. *Cash* is the ratio of cash and cash equivalent to total assets. *Abnormal Return* is the return of the firm in year *t* minus the market return of the last 12 months of fiscal period. *log (CEO Tenure)* refers to the log value of the number of years a CEO has in office. *CEO Duality* is a dummy variable that takes a value of 1 if a CEO also serves as the chairman of the board, and 0 otherwise. *Outsider Dummy* is a dummy variable that takes a value of 1 if a CEO is hired from outside, and 0 otherwise. We also report the R-square value, and the asterisks *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Variables	DV = Bankruptcy Dummy					
	Outsider Percentage >= Median			Outsider Percentage < Median		
	(1)	(2)	(3)	(4)	(5)	(6)
Over Confidence	-0.180*** (11.69)			-0.108* (3.71)		
Moderate Confidence		-0.093 (1.67)			0.021 (0.10)	
Low Confidence			0.217*** (15.10)			0.077 (2.07)
Profit	-0.247*** (397.77)	-0.309*** (405.62)	-0.296*** (394.75)	-0.263*** (333.17)	-0.199*** (334.70)	-0.1789*** (329.17)
Leverage	11.488*** (302.60)	11.208*** (299.11)	11.486*** (302.73)	40.625*** (465.85)	40.637*** (465.73)	40.579*** (465.55)
Size	0.140*** (49.74)	0.136*** (47.67)	0.145*** (52.24)	0.091*** (26.01)	0.088*** (24.44)	0.092*** (26.41)
Market-to-Book	-0.020 (0.80)	-0.029 (1.70)	-0.020 (0.76)	-0.114*** (13.32)	-0.103*** (11.27)	0.111*** (12.77)
Cash	-0.702*** (47.72)	-0.700*** (47.63)	-0.699*** (47.15)	-0.736*** (41.79)	-0.732*** (40.93)	-0.735*** (41.63)
Abnormal Return	-0.965*** (223.66)	-0.963*** (219.07)	-0.964*** (220.60)	-0.985*** (199.70)	-0.985*** (198.02)	-0.984*** (197.95)
Log (CEO Tenure)	-0.128*** (27.12)	-0.130*** (28.19)	-0.128*** (27.00)	-0.045 (2.21)	-0.051*** (2.86)	-0.046*** (2.29)
CEO Duality	0.411*** (54.45)	0.411*** (54.52)	0.408*** (53.82)	0.225*** (15.01)	0.229*** (15.51)	0.224*** (14.87)
Outsider Dummy	0.106* (2.90)	0.109* (3.05)	0.101 (2.62)	0.170** (4.32)	0.170** (4.30)	0.168** (4.20)
N	5227	5227	5227	4450	4450	4450
Pseudo R-square	0.2603	0.2589	0.2608	0.2818	0.2812	0.2815
Industry FF	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Table 3.6. Probit analysis on the relation of CEO confidence and probability of bankruptcy, in the presence of institutional investors.

The table presents probit regression results of how CEO overconfidence, moderate confidence and low confidence, estimated by following Campbell et al. 2011, impact the probability of bankruptcy, in the presence of institutional shareholders. The dependent variable is a dummy variable that takes a value of 1 if the bankruptcy scores following Shumway (2001) belong to top quartile, and 0 otherwise. *Profit* refers to net income scaled by total assets. *Leverage* refers to total debt scaled by total assets. *Size* refers to the log value of total assets. *Market-to-Book* is the ratio of total assets minus book value of equity plus market value of equity scaled by total assets. *Cash* is the ratio of cash and cash equivalent to total assets. *Abnormal Return* is the return of the firm in year t minus the market return of the last 12 months of fiscal period. *log (CEO Tenure)* refers to the log value of the number of years a CEO has in office. *CEO Duality* is a dummy variable that takes a value of 1 if a CEO also serves as the chairman of the board, and 0 otherwise. *Outsider Dummy* is a dummy variable that takes a value of 1 if a CEO is hired from outside, and 0 otherwise. We also report the R-square value, and the asterisks *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Variables	DV = Bankruptcy Dummy		
	(1)	(2)	(3)
Over Confidence	-0.332*** (12.56)		
Moderate Confidence		-0.321 (1.68)	
Low Confidence			0.224** (4.93)
Institutional Holding	-0.319** (5.64)	-0.366*** (7.45)	-0.028 (0.02)
Profit	-1.201*** (928.52)	-1.200*** (938.22)	-1.202*** (920.12)
Leverage	0.749*** (875.96)	0.749*** (875.49)	0.749*** (876.71)
Size	0.075*** (51.40)	0.073*** (48.87)	0.078*** (55.96)
Market-to-Book	0.004 (0.05)	-0.004 (0.07)	0.005 (0.10)
Cash	-6.376*** (105.73)	-6.540*** (105.02)	-6.376*** (105.87)
Abnormal Return	-1.435*** (432.04)	-1.439*** (425.16)	-1.439*** (427.53)
Log (CEO Tenure)	-0.141*** (45.96)	-0.145*** (48.17)	-0.139*** (45.10)
CEO Duality	0.227*** (83.51)	0.227*** (83.57)	0.225*** (81.86)
Outsider Dummy	0.126*** (11.74)	0.125*** (11.60)	0.122*** (10.97)
Over Confidence*Inst. Holding	-0.150 (0.49)		
Moderate Confidence*Inst. Holding		0.236 (1.01)	
Low Confidence*Inst. Holding			0.329 (1.38)
N	11230	11230	11230
Pseudo R-square	0.2681	0.2673	0.2684
Industry FF	Y	Y	Y
Year FE	Y	Y	Y

Table 3.7. Probit analysis on the relation of CEO confidence and probability of bankruptcy, in the presence of high vs low level of institutional holdings

The table presents probit regression results of how CEO overconfidence, moderate confidence and low confidence, estimated by following Campbell et al. 2011, impact the probability of bankruptcy, in the presence of higher and lower level of institutional holdings compared to the median value. The dependent variable is a dummy variable that takes a value of 1 if the bankruptcy scores following Shumway (2001) belong to top quartile, and 0 otherwise. *Profit* refers to net income scaled by total assets. *Leverage* refers to total debt scaled by total assets. *Size* refers to the log value of total assets. *Market-to-Book* is the ratio of total assets minus book value of equity plus market value of equity scaled by total assets. *Cash* is the ratio of cash and cash equivalent to total assets. *Abnormal Return* is the return of the firm in year t minus the market return of the last 12 months of fiscal period. *log (CEO Tenure)* refers to the log value of the number of years a CEO has in office. *CEO Duality* is a dummy variable that takes a value of 1 if a CEO also serves as the chairman of the board, and 0 otherwise. *Outsider Dummy* is a dummy variable that takes a value of 1 if a CEO is hired from outside, and 0 otherwise. We also report the R-square value, and the asterisks *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Variables	DV = Bankruptcy Dummy Major Institutional Holding			DV = Bankruptcy Dummy Minor Institutional Holding		
	(1)	(2)	(3)	(4)	(5)	(6)
Over Confidence	-0.176*** (13.69)			-0.101* (3.32)		
Moderate Confidence		-0.009 (0.02)			-0.127* (3.81)	
Low Confidence			0.170*** (11.58)			0.161*** (8.93)
Profit	-0.198*** (388.23)	-0.261*** (391.52)	-0.170*** (383.09)	-0.197*** (534.26)	-0.143*** (539.09)	-0.170*** (529.77)
Leverage	14.672*** (393.24)	14.621*** (392.49)	14.574*** (391.85)	24.664*** (482.34)	24.716*** (482.70)	24.860*** (483.61)
Size	0.188*** (85.60)	0.182*** (80.23)	0.192*** (88.08)	0.026* (2.98)	0.026* (3.13)	0.030** (4.15)
Market-to-Book	-0.0745*** (7.72)	-0.056** (4.57)	-0.073*** (7.38)	-0.025 (1.51)	-0.028 (1.91)	0.022 (1.13)
Cash	-0.655*** (42.79)	-0.649*** (41.71)	-0.652*** (42.32)	-0.726*** (60.90)	-0.726*** (61.01)	-0.726*** (61.16)
Abnormal Return	-0.972*** (234.22)	-0.971*** (228.44)	-0.971*** (230.18)	-0.954*** (200.49)	-0.953*** (198.01)	-0.953*** (199.07)
Log (CEO Tenure)	-0.116*** (22.05)	-0.121*** (24.13)	-0.115*** (21.64)	-0.119*** (24.48)	-0.120*** (25.03)	-0.117*** (23.79)
CEO Duality	0.410*** (57.79)	0.418*** (59.75)	0.410*** (57.80)	0.267*** (26.51)	0.260*** (25.26)	0.261*** (25.39)
Outsider Dummy	0.138** (4.60)	0.134** (4.36)	0.136** (4.46)	0.171*** (7.11)	0.167*** (6.81)	0.161** (6.38)
N	5739	5739	5739	5491	5491	5491
Pseudo R-square	0.2455	0.2437	0.2452	0.2969	0.2969	0.2976
Industry FF	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Table 3.8. Probit analysis on the relation of CEO overconfidence and the probability of bankruptcy, in the presence of high vs low level of short-term debt.

The table presents probit regression results of how CEO overconfidence, moderate confidence and low confidence, estimated by following Campbell et al. 2011, impact the probability of bankruptcy, in the presence of higher and lower level of short-term debts compared to the median value. The dependent variable is a dummy variable that takes a value of 1 if the bankruptcy scores following Shumway (2001) belong to top quartile, and 0 otherwise. *Profit* refers to net income scaled by total assets. *Leverage* refers to total debt scaled by total assets. *Size* refers to the log value of total assets. *Market-to-Book* is the ratio of total assets minus book value of equity plus market value of equity scaled by total assets. *Cash* is the ratio of cash and cash equivalent to total assets. *Abnormal Return* is the return of the firm in year *t* minus the market return of the last 12 months of fiscal period. *log (CEO Tenure)* refers to the log value of the number of years a CEO has in office. *CEO Duality* is a dummy variable that takes a value of 1 if a CEO also serves as the chairman of the board, and 0 otherwise. *Outsider Dummy* is a dummy variable that takes a value of 1 if a CEO is hired from outside, and 0 otherwise. We also report the R-square value, and the asterisks *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Variables	DV = Bankruptcy Dummy					
	High Short-Term Debt	Low Short-Term Debt	High Short-Term Debt	Low Short-Term Debt	High Short-Term Debt	Low Short-Term Debt
	(1)	(2)	(3)	(4)	(5)	(6)
Over Confidence	-0.219*** (7.85)	-0.060 (0.70)				
Moderate Confidence			0.174*** (7.85)	0.068 (0.90)		
Low Confidence					0.076 (0.52)	0.004 (0.00)
Profit	-0.167*** (712.54)	-0.223*** (920.13)	-0.167*** (715.23)	-0.223*** (919.98)	-0.167*** (714.13)	-0.223*** (924.51)
Leverage	0.544*** (188.68)	0.685*** (451.02)	0.544*** (188.78)	0.685*** (451.03)	0.541*** (185.16)	0.685*** (451.09)
Size	0.147*** (420.23)	0.152*** (256.15)	0.147*** (418.82)	0.152*** (256.45)	0.146*** (413.85)	0.151*** (255.36)
Market-to-Book	-0.277*** (77.57)	-0.057*** (13.54)	-0.277*** (77.42)	-0.057*** (13.57)	-0.278*** (77.64)	-0.057*** (13.56)
Cash	-0.373*** (33.01)	-0.959*** (38.46)	-0.498*** (33.34)	-0.964*** (38.53)	-0.435*** (33.16)	-0.957*** (38.44)
Abnormal Return	1.602*** (285.33)	1.616*** (260.65)	1.600*** (286.67)	1.616*** (260.41)	1.603*** (284.98)	1.614*** (261.46)
Log (CEO Tenure)	-0.052*** (8.13)	-0.086*** (16.55)	-0.055*** (9.05)	-0.086*** (16.90)	-0.061*** (11.02)	-0.090*** (18.26)
CEO Duality	0.124*** (22.02)	0.142*** (22.55)	0.123*** (21.82)	0.142*** (22.52)	0.124*** (22.16)	0.142*** (22.61)
Outsider Dummy	0.117*** (9.29)	0.169*** (20.54)	0.117*** (9.41)	0.169*** (20.67)	0.118*** (9.57)	0.169*** (20.61)
N	9177	10231	9177	10231	9177	10231
Pseudo R-square	0.2429	0.2407	0.2367	0.2407	0.2361	0.2406
Industry FF	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Table 3.9. Probit analysis on the relation of CEO overconfidence and the probability of bankruptcy, in the presence of agency cost.

The table presents the probit regression results of how CEO overconfidence, moderate confidence and low confidence, estimated by following Campbell et al. 2011, impact the probability of bankruptcy, in the presence of higher and lower level of free cash flow compared to the median value. The dependent variable is a dummy variable that takes a value of 1 if the bankruptcy scores following Shumway (2001) belong to top quartile, and 0 otherwise. *Profit* refers to net income scaled by total assets. *Leverage* refers to total debt scaled by total assets. *Size* refers to the log value of total assets. *Market-to-Book* is the ratio of total assets minus book value of equity plus market value of equity scaled by total assets. *Cash* is the ratio of cash and cash equivalent to total assets. *Abnormal Return* is the return of the firm in year t minus the market return of the last 12 months of fiscal period. *log (CEO Tenure)* refers to the log value of the number of years a CEO has in office. *CEO Duality* is a dummy variable that takes a value of 1 if a CEO also serves as the chairman of the board, and 0 otherwise. *Outsider Dummy* is a dummy variable that takes a value of 1 if a CEO is hired from outside, and 0 otherwise. We also report the R-square value, and the asterisks *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Variables	DV= Bankruptcy Dummy					
	FCF >= median	FCF < median	FCF >= median	FCF < median	FCF >= median	FCF < median
	High	Low	High	Low	High	Low
	(1)	(2)	(1)	(2)	(1)	(2)
Over Confidence	-0.165** (4.69)	-0.096 (1.73)				
Moderate Confidence			0.175*** (7.78)	0.054 (0.57)		
Low Confidence					-0.045 (0.13)	0.131 (1.48)
Profit	-0.166*** (524.13)	-0.251*** (722.17)	-0.166*** (524.08)	-0.251*** (724.36)	-0.165*** (526.51)	-0.251*** (724.01)
Leverage	0.755*** (988.83)	0.472*** (81.92)	0.755*** (990.04)	0.471*** (81.53)	0.755*** (986.61)	0.471*** (81.36)
Size	0.045*** (21.41)	0.195*** (615.46)	0.045*** (21.39)	0.194*** (614.80)	0.044*** (20.04)	0.194*** (615.87)
Market-to-Book	0.011 (0.48)	-0.120*** (29.86)	0.011 (0.48)	-0.120*** (29.85)	0.011 (0.46)	-0.120*** (29.61)
Cash	-0.255*** (22.73)	-0.297*** (102.19)	-0.267*** (22.90)	-0.208*** (102.83)	-0.243*** (22.55)	-0.302*** (102.16)
Abnormal Return	1.402*** (423.33)	1.826*** (210.53)	1.402*** (424.15)	1.825*** (210.82)	1.402*** (424.34)	1.823*** (211.17)
Log (CEO Tenure)	-0.126*** (38.87)	-0.036* (3.11)	-0.126*** (39.45)	-0.039* (3.74)	-0.135*** (45.07)	-0.039* (3.66)
CEO Duality	0.207*** (70.39)	0.134*** (19.40)	0.206*** (69.97)	0.134*** (19.42)	0.207*** (70.51)	0.134*** (19.53)
Outsider Dummy	0.126*** (10.80)	0.114*** (7.96)	0.126*** (10.86)	0.115*** (8.05)	0.127*** (11.09)	0.113*** (7.87)
N	12289	7119	12289	7119	12289	7119
Pseudo R-square	0.2206	0.2496	0.2208	0.2495	0.2203	0.2496
Industry FF	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Table 3.10. Probit analysis on the relation of CEO overconfidence and the probability of bankruptcy, in the presence of credit ratings.

The table presents the probit regression results of how CEO overconfidence, moderate confidence and low confidence, estimated by following Campbell et al. 2011, impact the probability of bankruptcy, for firm with and without credit ratings. The dependent variable is a dummy variable that takes a value of 1 if the bankruptcy scores following Shumway (2001) belong to top quartile, and 0 otherwise. *Profit* refers to net income scaled by total assets. *Leverage* refers to total debt scaled by total assets. *Size* refers to the log value of total assets. *Market-to-Book* is the ratio of total assets minus book value of equity plus market value of equity scaled by total assets. *Cash* is the ratio of cash and cash equivalent to total assets. *Abnormal Return* is the return of the firm in year t minus the market return of the last 12 months of fiscal period. *log (CEO Tenure)* refers to the log value of the number of years a CEO has in office. *CEO Duality* is a dummy variable that takes a value of 1 if a CEO also serves as the chairman of the board, and 0 otherwise. *Outsider Dummy* is a dummy variable that takes a value of 1 if a CEO is hired from outside, and 0 otherwise. We also report the R-square value, and the asterisks *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Variables	DV = Bankruptcy Dummy					
	Credit Rating					
	Yes (1)	No (2)	Yes (3)	No (4)	Yes (5)	No (6)
Over Confidence	-0.072** (4.49)	-0.153*** (13.38)				
Moderate Confidence			-0.054 (1.92)	-0.027 (0.22)		
Low Confidence					0.091*** (8.26)	0.149*** (12.44)
Profit	-1.000*** (660.07)	-0.998*** (1115.97)	-1.000*** (663.58)	-0.998*** (1134.18)	-1.000*** (651.25)	-0.998*** (1109.92)
Leverage	2.877*** (252.93)	5.182*** (217.06)	2.894*** (254.72)	5.033*** (212.44)	2.877*** (252.86)	5.155*** (216.31)
Size	0.115*** (135.13)	0.455*** (601.22)	0.114*** (133.81)	0.447*** (588.23)	0.117*** (138.94)	0.457*** (601.89)
Market-to-Book	-0.106*** (25.07)	-0.079*** (22.26)	-0.110*** (27.70)	-0.087*** (27.61)	-0.104*** (24.59)	-0.079*** (22.53)
Cash	-0.476*** (21.86)	-0.553*** (52.74)	-0.469*** (21.07)	-0.554*** (53.32)	-0.477*** (22.08)	-0.553*** (52.93)
Abnormal Return	-0.941*** (306.24)	-0.934*** (261.81)	-0.940*** (302.53)	-0.933*** (256.99)	-0.941*** (304.10)	-0.933*** (258.57)
Log (CEO Tenure)	-0.081*** (24.17)	-0.048** (5.79)	-0.082*** (25.55)	-0.049** (5.87)	-0.080*** (23.59)	-0.047** (5.58)
CEO Duality	0.229*** (47.99)	0.123*** (9.17)	0.228*** (47.52)	0.123*** (9.28)	0.229*** (47.95)	0.120*** (8.90)
Outsider Dummy	0.252*** (23.21)	0.180*** (14.20)	0.247*** (22.34)	0.184*** (14.79)	0.249*** (22.61)	0.177*** (13.81)
N	9440	9351	9440	9351	9440	9351
Pseudo R-square	0.2159	0.2707	0.2156	0.2697	0.2162	0.2707
Industry FF	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

Appendix 1.A – Essay 1 variable definitions

Definitions of variables used in the analysis of chief executive officer (CEO) ability and corporate bankruptcy. BRD is Bankruptcy Research Database. DEF14A is the proxy statement, retrieved from EDGAR (Electronic Data Gathering, Analysis, and Retrieval system). 13Fs are from Thomson One database.

Variable	Description	Data Source
CEO Characteristics		
Log of CEO Age	Log of (1 + CEO age)	EXECUCOMP, DEF14A
CEO Duality	Dummy variable equal to 1 if a CEO assumes the role of Chairman of the board, and 0 otherwise	EXECUCOMP, DEF14A
Outsider Dummy	Dummy variable equal to 1 if a CEO assumes is hired from outside, and 0 otherwise	EXECUCOMP, DEF14A
Incumbent	CEO in place at end of fiscal year –3 relative to year of filing.	10 Ks, DEF14A, Factiva
Founder incumbent	Dummy indicating that the incumbent CEO is the company founder.	10 Ks, DEF14A, Factiva
Non-founder incumbent	Dummy indicating that the incumbent CEO is not the company founder.	10 Ks, DEF14A, Factiva
Log of CEO Cash Compensation	Log of (Salary + Bonus)	EXECUCOMP, DEF14A
Proportion of Cash pay	CEO cash compensation divided by total compensation	EXECUCOMP, DEF14A
CEO Common Stock value	stock price (PRCCF) × shares owned (SHROWN_EXCL_OPTS)	EXECUCOMP, DEF14A
CEO Option Value	The aggregate value of stock options granted to the executive during the year as valued using S&P's Black Scholes methodology	EXECUCOMP, DEF14A
Total Compensation	Salary + Bonus + Other Annual + Restricted Stock Grants + LTIP Payouts + All Other + Value of Option Grants	EXECUCOMP, DEF14A
Firm Characteristics		
Investment	Capital expenditures (CAPX) over net property, plant, and equipment at the beginning of the fiscal year (PPENT).	EXECUCOMP
Cash flow	Sum of earnings before extraordinary items (IB) and depreciation (DP) over net property, plant, and equipment at the beginning of the fiscal year (PPENT).	EXECUCOMP
Leverage	Long-term debt (DLTT) plus debt in current liabilities (DLC) over long-term debt plus debt in current liabilities plus the book value of common equity (CEQ).	EXECUCOMP, BRD
Cash holdings	Cash and short-term investments (CHE) over net property, plant, and equipment at the beginning of the fiscal year (PPENT).	EXECUCOMP
Interest coverage	Earnings before depreciation, interest, and tax (OIBDP) over interest expenses (XINT)	EXECUCOMP
Dividends over earnings	Ratio of the sum of common dividends (DVC) and preferred dividends (DVP) over earnings before depreciation, interest, and tax (OIBDP).	EXECUCOMP
Advertising	Ratio of advertising expenditures (XAD) over lagged total assets (AT).	EXECUCOMP
SG&A	Ratio of selling, general, and administrative expenses (XSGA) over sales (SALE).	EXECUCOMP
Return on assets	Ratio of EBITDA (IB) over lagged total assets (AT).	EXECUCOMP, BRD
Percent shares held by large block holders	Fraction of shares that are owned by block holders with 10 percent or more of the firm's outstanding shares (based on the last quarter of each year).	13F

Appendix 2.A – Essay 2 variable descriptions

Definition of variables used in the analysis of chief executive officer (CEO) risk preference and corporate bankruptcy.

CEO Characteristics		
Log of CEO Age	Log of (1 + CEO age)	EXECUCOMP
CEO Duality	Dummy variable equal to 1 if a CEO assumes the role of Chairman of the board, and 0 otherwise	EXECUCOMP
Outsider Dummy	Dummy variable equal to 1 if a CEO assumes is hired from outside, and 0 otherwise	EXECUCOMP
CEO inside debt	total aggregate balance in deferred compensation plans at fiscal year (DEFER_BALANCE_TOT) + present value	EXECUCOMP
CEO unvested stock value	stock price (PRCCF) × restricted stock holdings (STOCK_UNVEST_NUM);	EXECUCOMP
CEO common stock value	stock price (PRCCF) × shares owned (SHROWN_EXCL_OPTS);	EXECUCOMP
CEO equity holdings	CEO common stock value + CEO unvested stock value + CEO stock options value;	EXECUCOMP
CEO cash compensation	salary (SALARY) + bonus (BONUS);	EXECUCOMP
CEO leverage	CEO inside debt / CEO equity holdings;	EXECUCOMP
CEO relative leverage	CEO leverage / [debt/equity];	EXECUCOMP
High CEO relative leverage	a dummy variable = one if CEO relative leverage > [debt/equity], and zero otherwise.	EXECUCOMP
Firm Characteristics		
Book Leverage	Long-Term Debt – Total (DLTT) +Debt in Current Liabilities - Total (DLC)/Assets - Total (AT)	COMPUSTAT
Cash	Cash and Short-Term Investments (CHE)/Assets - Total (AT)	COMPUSTAT
Capital Exp.	Capital Expenditures (CAPX/AT)	COMPUSTAT
Dividend Cut	Indicator variable that takes the value of one if there is a reduction in annual dividend, and zero otherwise	COMPUSTAT
Market-to-Book	[Assets - Total (AT) – Common/Ordinary Equity - Total (CEQ) + Price Close - Annual (PRCC)* Common Shares Outstanding (CSHO)] / Assets – Total (AT)	COMPUSTAT
Net PPENT	Net Property, Plant, and Equipment to assets (PPENT/AT)	COMPUSTAT
R&D	Research and development expenditure to assets = Max(0,XRD)/Assets - Total (AT)	COMPUSTAT
ROA	Return on Assets = Operating Income Before Depreciation (OIBDP)/Assets - Total (AT)	COMPUSTAT
Size	Log (Assets - Total (AT))	COMPUSTAT
Segments	Number of operating segments as reported in Compustat segment database	COMPUSTAT

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- Nominated for Outstanding Graduate Teaching Assistant Award 2019 – Classroom instruction (Old Dominion University)
- Ph.D. Student Tuition Waiver (2018 – 2019) (Old Dominion University)
- Ph.D. Student Financial Assistantship (2014 – 2017) (Old Dominion University)
- Graduate Assistant Subsidized Tuition (2007 – 2009) (Iowa State University)
- Graduate Assistant Scholarship (2007 – 2009) (Iowa State University)
- Awarded under the National Scholarship Scheme of the Government of India on the result of Bachelor of Commerce (Hons.) Examination (August 2000) held by the University of Calcutta.
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