Executive Compensation Linked to Corporate Social Responsibility and Firm Risk

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Abstract:

This paper examines if and how corporate social responsibility (CSR) linked compensation influences the effect of vega of executive options portfolio on corporate risk. Using a two-stage least squares (2SLS) regression estimation to treat endogeneity, we find that CSR linked compensation reduces the positive effect of vega on firm risk when risk is above optimal level (i.e. when executives take excessive risk). However, when risk is below optimal level, CSR linked compensation does not significantly impact the positive relation between vega and firm risk. The results are robust to using difference-in-differences models and matched sample analysis. Overall, our findings suggest that boards use CSR linked compensation to mitigate managerial excessive risk taking induced by option-based executive compensation.

1. Introduction

Agency theory (Jensen and Meckling, 1976) postulates that firms link managerial pay to stock options to induce risk averse managers to take more risk. Options have convex payoffs that enable managers to benefit when risky projects succeed but do not penalize them when those projects fail. The risk taking incentives embedded in option-based compensation, however, do not always lead to optimal levels of risk, and sometimes result in excessive risk taking.[1] Previous studies show that CEOs with more incentives from option-based compensation are more likely to take excessive risk (e.g., Sanders and Hambrick, 2007; Dong et al., 2010), make value destroying investments (e.g., Ryan and Wiggins, 2002) and involve in accounting fraud and earnings management (e.g., Bergstresser and Philippon, 2006; McAnally et al., 2008).

This study argues that boards recognize the possibility of excessive risk taking incentives from option-based compensation and link managerial pay to corporate social responsibility (CSR) performance to manage these incentives. Previous theoretical and empirical literature suggests that CSR, besides being a value increasing strategic investment, also provides an effective tool to manage risk. Studies like Godfrey et al., (2009), Luo and Bhattacharya (2009), and Bouslah et al., (2013) show that CSR engagement leads to lower firm risk. We expect that boards are more likely to link managerial compensation to CSR when they expect that vega may induce excessive risk taking. We understand that incentives from option-based incentives and from CSR linked compensation may be determined by the same underlying factors. We therefore explicitly recognize the simultaneity of CSR and option-based compensation and use instrument variable

[1] The financial crisis report of the National Commission on the Causes of the Financial and Economic Crisis in the United States noted that "[stock options] pay structures had the unintended consequences of creating incentives to increase both risk and leverage."[p. 91]

approach to investigate if and how CSR linked compensation influences the relation between incentives from option compensation (i.e. vega) and corporate risk.

Using vega of the portfolio of option compensation, data on firms that link compensation to CSR and measures of firm total and idiosyncratic risks, we find empirical results that are consistent with the above expectations. Specifically, we find that after controlling for manager, governance and firm characteristics, vega of executive compensation has a positive effect and CSR linked compensation has a negative effect on both measures of firm risk. However, further tests indicate that CSR linked compensation reduces the positive impact of vega on firm risk. More interestingly, we find that CSR linked compensation reduces the effect of vega on firm risk only when firm risk is above the optimal level (excessive risk). When firm risk is below optimal levels, CSR linked compensation has no significant impact on the effect of vega on firm risk. These findings suggest that boards use CSR linked compensation as a risk management strategy to mitigate the excessive risk taking behavior induced by incentives from option-based compensation.

This paper contributes to the literature on managerial incentives, compensation, and corporate risk taking. It contributes to the nascent literature that examines CSR linked compensation (e.g., Hong et al., 2016; Maas, 2018; Flammer et al., 2019). It shows that boards use CSR linked compensation to reduce excessive managerial risk taking. To the best of our knowledge, this is the first paper to document this effect. It also shows that CSR linked compensation acts as a risk management tool and has a negative effect on corporate risk. In this respect, it adds to the literature on CSR and corporate risk taking (e.g., Godfrey et al., 2009; Bouslah et al., 2013). This paper also sheds some light on how CSR linked compensation may be used by boards as a mechanism to influence firm risk orientation. Given the long-term orientation, and risk reducing effect of CSR,

boards may use CSR linked compensation to induce executives to focus on long-term goals when making investment decisions.

The remaining of the paper is organized as follows. Section 2 presents the foundations and hypotheses development. Section 3 describes data, measurement of variables and the empirical methodology. Section 4 discusses the results, and section 5 concludes.

2. Background and Hypotheses Development

Agency theory (Jensen and Meckling, 1976) argues that managerial interests do not always align with those of shareholders due to separation of ownership and control. It explains that shareholders are well-diversified and risk-neutral, and prefer to accept all value increasing risky investment projects. Managers, however, are risk-averse and poorly diversified as most of their financial wealth and human capital are tied to their firms. Managers, therefore, may be inclined to make sub-optimal investment decisions and take less risk than the shareholders would like them to (Amihud and Lev, 1981; Smith and Stulz, 1985; Eisenhardt, 1989; Holmstrom, 1999). Agency theory further suggests that adding stock options to executive compensation packages encourages risk-averse managers to increase firm risk. This is because options have convex payoff structures that protect managerial wealth from downside risk but enable them to benefit from upside potential.

Consistent with the predictions of agency theory, several empirical studies find that vega of option compensation (the sensitivity of manager's wealth to stock return volatility) is positively associated with corporate risk taking (Tufano, 1996; Guay, 1999; Rajgopal and Shevlin, 2002; Coles et al., 2006; Low, 2009). While most of these studies report that option-based compensation

motivates managers to increase risk, there are a few studies that point out that incentives from option compensation may induce managers to engage in excessive risk taking and value destroying investments. Sanders and Hambrick (2007) for example, report that stock options induce managers to make high-variance bets that result in more big losses. Dong et al. (2010) argue that stock options induce excessive risk taking and make managers pursue suboptimal capital structure polices. Gormley et al. (2013) find that boards recognize the risk taking incentives from stock options and reduce compensation convexity (option-based compensation) to discourage risk taking by their managers.

On the other hand, the literature on CSR suggests that besides being a value increasing strategic investment (Kruger, 2015), CSR is also used as a risk management strategy. Theorists argue that CSR provides insurance like protection in the event of poor performance and negative events (Godfrey, 2005; Peloza, 2006; Godfrey et al., 2009). CSR generates moral capital and goodwill that acts as a mitigating factor in case of negative events and reduces the "severity of sanctions by encouraging stakeholders to give the firm 'the benefit of the doubt' when ambiguity over motive exists" (Godfrey et al., 2009). This moral capital also creates "relational wealth" through improved relations with different stakeholder groups. CSR may increase brand trust and credibility and customer loyalty, employee commitment, supplier and partners trust, legitimacy with communities and the government, and attractiveness and dependability for investors (Luo and Battacharya, 2009). These attributes are associated with more stable cash flows and lower volatility of stock prices. CSR engagement may also lower the risks associated with resource acquisition (Haley 1991; Berman et al. 1999), as CSR strengthens a firm's reputation and its relationship with key stakeholders that, in turn, are more willing to provide the firm with the resources they control (Frooman 1999; Backhaus et al. 2002).

A number of studies show that CSR is associated with lower cost of capital (Sharfman and Fernando, 2008; El Ghoul et al., 2011; Girerd-Potin et al., 2014; Ng and Rezaee, 2015) and that high CSR firms are perceived less risky by investors (Robinson et al., 2008; Starks, 2009; Luo and Battacharya, 2009; Oikonomou et al., 2012; Bouslah et al., 2013). The strand of literature that examines the relation between CSR and firm risk, find that CSR leads to a reduction in corporate risk taking (Godfrey et al., 2009; Chakraborty et al., 2019). Given this evidence, Harjoto and Laksmana (2018) propose that CSR serves as a control mechanism to reduce deviations from optimal risk taking. They argue that firms with a CSR focus avoid excessive risk taking and excessive risk avoidance because they balance the interests of both investing and non-investing stakeholders. Firms avoid excessive risk taking when considering the interests of non-investing stakeholders that, in turn, are more willing to provide to the firm the critical resources they control. At the same time, firms prevent excessive risk avoidance when considering the investors' interests. There are no studies to our knowledge that explore the direct relation between CSR linked compensation and corporate risk taking. Among the related studies, Hong et al., (2016) examine the association between CSR linked compensation and corporate governance and find that firms with shareholder-friendly corporate governance are more likely to provide compensation linked to social performance outcomes. Flammer et al., (2019) show that CSR linked compensation increases long-term orientation and firm value. We further this emerging literature by exploring the association between CSR linked compensation, option-based compensation and firm risk. Specifically, we argue that given the empirical evidence that CSR linked compensation provides incentives to invest in long-term sustainable projects and firms use CSR as a risk reducing strategy, managers whose compensation is linked to CSR outcomes, are more likely to reduce firm risk.

***Hypothesis 1*:** CSR linked compensation is negatively related to corporate risk.

Furthermore, the above discussion suggests that the negative effect of CSR linked compensation may reduce the positive effect of vega of executive compensation on firm risk which leads to the following hypothesis.

***Hypothesis 2*:** CSR linked compensation mitigates the positive impact of vega on corporate risk.

Previous literature on risk taking incentives suggests that giving higher vega sometimes induces managers to take more risk than is optimal by investing in value decreasing investment policies. Harjoto and Laksmana (2018), find that CSR reduces both negative (excessive risk avoidance) and positive (excessive risk taking) deviations from optimal risk taking. We argue that CSR linked compensation is a risk management tool and boards use it to mitigate excessive risk taking. It is therefore more likely for CSR linked compensation to reduce the positive effect of vega on risk taking when managers take more than optimal risk. In such situations, reducing firm risk leads to higher firm value by discouraging investment in value decreasing investments. However, when corporate risk levels are below optimal and managers need incentives to increase firm risk, CSR linked compensation should not affect the positive (risk taking) impact of vega on firm risk. We therefore hypothesize that CSR linked compensation reduces the positive impact of vega on corporate risk when the deviation from optimal risk levels is positive (excessive risk taking) and may not affect risk when the deviation from optimal risk levels is negative.

***Hypothesis 3*:** CSR linked compensation mitigates the positive impact of vega on corporate risk when the deviation from optimal risk is positive.

3. Data

3.1. CSR Linked Compensation

The data on CSR linked compensation was extracted from Bloomberg for the years 2010 to 2015 for all the companies in included in the Russel 3000 index. These companies comprise of the 3000 largest publicly held companies in the United States and represents approximately 98% of all the equity markets. It is important to note that the criteria for CSR linked compensation is not same for every firm and firms do not provide clear numeric goals for such criteria. For example, while American Express set targeted employee diversity measures in advance, the compensation committee at Kohl's subjectively reviewed their managers' social performance. We therefore use a firm-level indicator variable to flag the existence of CSR linked compensation, following previous studies (e.g., Hong et al., 2016); Flammer et al., 2019). We also manually collected data from the companies' proxy statements for the year 2015 and cross checked if companies included CSR linked compensation in their compensation packages. Our classification matched the data downloaded from Bloomberg. Since our study is at the executive level, we assume that if the firm offers CSR linked compensation to its top executive for a certain year, then all the top executives of that firm-year received CSR linked compensation. This is in line with Flammer et al. (2019) who gathered CSR linked compensation data manually from proxy statements and reported that 94% of the firms in their sample offer CSR linked compensation to the top five executives if the CEO was given CSR linked compensation.

We merge CSR linked compensation data with other data like MSCI ESG KLD STATS, Compustat, Execucomp and MSCI GMI Ratings. The resulting sample has 20,935 executive-year observations for 1,787 unique firms.

3.2. Measurement of Executive Risk Incentives

We measure managerial risk-taking incentives with the vega of option compensation using ExecuComp database. We follow the methodology of Guay (1999), Core and Guay (2002), Coles et al. (2006) and Hayes et al. (2012) and employ the Black-Scholes option valuation model as modified by Merton (1973) to construct vega and delta. Vega measures the change in the risk-neutral value of an executive's stock options for a 1% change in the volatility of the underlying stock. Delta measures the pay-performance sensitivity which is the change in the risk-neutral value of an executive's stock options for a 1% change in the price of the underlying stock. Option compensation motivates risk-averse managers to increase firm risk because the value of options increases with stock returns' volatility (i.e. firm risk). However, stock options also increase the sensitivity of managerial wealth to stock price (delta), discouraging risk-averse managers from taking on risky projects. The empirical literature is inconclusive regarding the relationship between the delta of managerial compensation and firm risk (e.g., Coles et al., 2006; Low, 2009). Vega is generally used to proxy for risk inducing incentives from option compensation.

3.3. Measurement of Firm Risk

We use two primary measures of firm risk: total risk and idiosyncratic risk. Total risk is calculated as the logarithm of the annualized standard deviation of daily stock returns, to account for the possible skewness of the risk measure. Idiosyncratic risk is estimated as the logarithm transformation of the annualized standard deviation of the residuals from the Fama-French three-factor market model. The data used to calculate stock returns are extracted from CRSP. Previous studies on the relation between vega and firm risk and CSR and firm risk use total and idiosyncratic risks (e.g., Bouslah et al., 2013; Harjoto and Laksmana, 2018). Luo and Bhattacharya (2009) argue that CSR engagement reduces firm-specific idiosyncratic risk by creating social capital that absorbs negative shocks.

We include two operational risk measures as well to test the robustness of our results following previous work (e.g., Acharya et al., 2011; Bargeron et al., 2010; Koirala et al., 2018). The first operational risk measure is the volatility of industry-adjusted ROA (STDROA), which is calculated as the standard deviation of the difference between subject firm's ROA and its industry median ROA within five years. ROA is defined as earnings before interest and taxes divided by assets. The other operational risk measure is CAPEX, which is calculated as capital expenditures scaled by total assets.

3.4. Corporate Social Responsibility

We use MSCI CSR STATS database (formerly known as the KLD Research and Analytics Database) data to construct CSR measures. KLD data are gathered from various sources, including company filings, questionnaires sent to companies, media sources and government data. Analysts from a sector-specific research team then evaluate and rate the firm. The database provides information on several indicators that capture "strengths" and "concerns" attributes in seven areas of social performance: community, employee relations, environment, diversity, human rights, governance and product. Each indicator is scored using a simple binary scoring model, where if a company meets the criteria established it is marked with a "1", and otherwise it is marked with a "0". Our measure of CSR is calculated by summing the total number of strengths and subtracting the total number of concerns for six areas. We do not include the governance dimension as the data measure governance very differently than the regular measures of corporate governance. We use other more rigorous measures of corporate governance variables while estimating our empirical models.

3.5. Control Variables

We control for executive, governance, and firm characteristics that are known to have impact on firm risk and managerial risk taking. At the firm level, we include size (log of total assets), market-to-book ratio (market value divided by total assets), leverage (total liabilities over market value), return on assets (earnings before interest and taxes divided by assets), advertising expenses over sales, growth in annual sales in prior years, and property, plant and equipment to sales. These data are obtained from Compustat. All continuous variables are winsorized at the 1st and 99th percentile, to exclude outliers.

The data used to construct executive's characteristics are extracted from ExecuComp. Following previous literature (Berger et al., 1997; Guay, 1999; Coles et al., 2006; Armstrong and Vashishtha, 2012; Harjoto and Laksmana, 2018), we include several variables that proxy for the degree of the executive's risk aversion, power in the company, and other factors that are likely to impact firms' investment policies. Specifically, we include the logarithm of the executive's cash compensation (CASHCOMP), the number of years of CEO tenure (CEOTENURE), the executive's stock ownership (SHROWN), a variable indicating if the executive also serves as a board member (EXECDIR), and a variable indicating whether the executive is the CEO.

Finally, we include board characteristics like board independence and size. We include percentage of independent directors (OUTSIDE), percentage of members that have served in the board for over 15 years to measure board tenure (OVER15), and the logarithm of the number of directors in the board in a given year (BOARDSIZE). Previous literature (Boeker and Goodstein 1993; Harris and Helfat 2007; Vafeas 2003; Wade et al. 1990) argues that as the tenure of board members increases, directors tend to develop personal and social connections with managers, leading to less independent boards. The data used to construct board characteristics are extracted from the MSCI GMI Ratings dataset.

3.6. Summary Statistics

Table 1 presents descriptive statistics for our sample. All variables are constructed as described above and are also reported in the summary in Appendix. Our sample contains relatively large firms, as the mean and median total assets are $13.18 billion and $2.6 billion, respectively. The median firm has a market-to-book ratio of 1.64, and a debt ratio of 12%. The mean (median) firm total risk in our sample, as measured by the standard deviation of daily returns for a year, is 2% (1.8%) and idiosyncratic risk is 1.6% (1.4%).

About 8% of the executives in our sample receive CSR linked compensation in their compensation package. Large firms are more likely to include CSR incentives in their executives' pay structures. In our sample, 18.67% of the S&P 500 firms adopt CSR linked compensation over the 6-year period. Statistics for the vega and delta of the executives' option compensation show that an increase of 1% in the volatility of the underlying stock would result in a mean (median) increase in the risk-neutral value of an executive's option compensation of around $58,228 ($15,536), and an increase of 1% in the price of the underlying stock would result in a mean (median) increase in the risk-neutral value of an executive's option compensation of around $93,515 ($23,317). The average (median) cash compensation (salary and bonus) received by an executive is $633,629 ($510,000). About 22% of the executives in our sample are CEO.

The mean (median) percentage of shares owned by an executive in our sample is 0.45% (0.07%), and around 32% of the executives are also board members. On average, 17% of the board members have served over 15 years, and a typical board has about 9 directors.

Table 2 presents the correlation coefficients of the variables included in the analysis. Consistent with our hypotheses, the likelihood of an executive's receiving CSR linked

compensation is positively related to his/her vega, and CSR linked compensation is negatively related with firm risk.

Table 3 reports the differences in means between executives who receive CSR linked compensation and those who do not receive CSR linked compensation for several of the variables of interest. Executives who receive CSR linked compensation, compared with those who do not, tend to own less shares of the firm, are less likely to be a director, work in larger firms and firms with lower total and idiosyncratic risk, higher CSR performance, and more independent and larger boards. In addition, executives with CSR linked compensation exhibit a higher vega of option compensation.

4. Empirical Methodology and Results

4.1. Effect of CSR Linked Compensation on Firm Risk

First, to examine the relation between CSR linked compensation and firm risk, we estimate a regression model that includes control variables for firm, executive and corporate governance characteristics, as well as year and industry fixed effects. At the firm level, we control for size, leverage, market-to-book, fixed assets, and growth. At the executive level we control for whether the executive is a CEO, cash compensation and CEO tenure to proxy CEO power. We also control for board independence and board size. While the inclusion of control variables and fixed effects mitigates the possibility that the results are driven by omitted variables, these models could still suffer from the endogeneity due to unobservable time-varying firm characteristics. This problem arises when CSR linked compensation adoption is correlated with unobservable and time-varying variables that also affect firm risk, in which case the estimated coefficients are inconsistent. We

performed endogeneity tests and calculated the Wu-Hausman F test statistic and Durbin-Wu-Hausman chi-square test statistic. Both test statistics are highly significant (65.22 for Wu-Hausman F test statistic and 65.06 for Durbin-Wu-Hausman chi-square test statistic), rejecting the null hypothesis that the CSR linked compensation could be treated as exogenous.

We use instrumental variables two-stage least squares (IV/2SLS) approach to address endogeneity in our models. Following Flammer and Kacperczyk (2016), Flammer (2018) and Flammer et al. (2019), we use the enactment of state-level constituency statutes as the instrumental variable. CONSTITUENCY is a state-level indicator variable that equals 1 if company headquarters are located in a state which has enacted constituency statutes by a certain year, and equals 0 otherwise. Since states that have enacted constituency statutes empower directors to balance interests among different groups of stakeholders [2] (e.g., Leung et al., 2019), we hypothesize that companies that are headquartered in such states are more likely to provide their managers with CSR linked compensation in their compensation packages. Although we do not expect this state-level variable to be correlated with firm risk, there might still be endogeneity concerns related to vegav(e.g., Armstrong and Vashishtha, 2012). To alleviate these concerns, we conduct additional tests using first order difference regressions and propensity score matching approach (discussed in section 4.4). While the difference-in-differences analysis helps in mitigating concerns about omitted variables, the propensity score matching method mitigates concerns of non-random selection and compares otherwise similar (including vega) observations with and without CSR linked compensation.

[2] Constituency statutes were enacted by legislatures from 35 states with the purpose of allowing directors to consider the interests of stakeholders other than the shareholders of the firm without breaching the fiduciary responsibilities to shareholders.

To test our first hypothesis, we estimate the following model as first-stage regression in the IV/2SLS approach:

$$CSRComp_{i,t} = a + b \times CONSTITUENCY_{i,t} + c \times control\ variables_{i,t} + e_{i,t} \quad (1)$$

Where, as discussed above CONSTITUENCY is dummy variable that equals one if firm i is incorporated in a state that has enacted a constituency statute by year t.

In the second stage, we estimate the effects of CSR linked compensation (instrumented) on firm risk using the following model:

$$Firm\ risk_{i,t+1} = a + b \times CSRComp_{i,t} + c \times control\ variables_{i,t} + e_{i,t+1} \quad (2)$$

Table 4 presents results from the regressions of CSR linked compensation on firm risk using two-stage least squares models. The first-stage regression results are shown in Column (1). As can be seen, the coefficient for CONSTITUENCY is positive and significant at the 1% level, indicating that the enactment of constituency statutes significantly increases the likelihood of firms adopting CSR linked compensation. The results indicate that firms incorporated in states that have enacted constituency statutes are 2.32% more likely to provide CSR linked compensation, holding all else constant at means. Given that 8% of the executives in our sample receive CSR linked compensation, we consider the effect of state-level constituency statutes significant. Vega is also significantly positive, suggesting that companies that provide more option compensation incentives for managerial risk taking are also more likely to provide CSR linked compensation. The first-stage Cragg-Donald F statistic is 32.24 is well above the critical value indicating the instrument used is strong.

Columns (2)-(5) of Table 4 present results from the second-stage regressions. These results show that providing executives with CSR linked compensation significantly reduces total risk,

idiosyncratic risk, and operational risk measures. The coefficient for the instrumented variable CSRcomp (abbreviation for CSR linked compensation) is negative and statistically significant at the 1% level in each of the models and for each of the different measures of risk, after controlling for both year and industry fixed effects, except in the model where we use industry-adjusted ROA volatility to proxy for firm risk and where instrumented CSR linked compensation is significant at the 5% level. The industry fixed effects have been estimated using Fama-French 48 industry classification. The coefficients suggest that increasing one standard deviation of the instrumented CSRComp for an otherwise average firm, decreases Total Risk by 1.65%, Idiosyncratic Risk by 2.23%, CAPEX by 6.51%, and STDROA by 9.03%. The coefficients on the control variables are generally consistent with previous research. As expected, vega is significantly positively related to all measures of firm risk. Previous literature finds mixed results on the relationship of risk and cash compensation (e.g., Coles et al., 2006) and PPE (e.g., Armstrong and Vashishtha, 2012). Our results support the view that managers with less cash compensation are less likely to hold well diversified personal portfolios and could be more risk-averse (May, 1995; Guay, 1999; Neyland, 2020). Overall, the results in Table 4 provide empirical support to Hypothesis 1 by showing the CSR linked compensation is significantly negatively related to firm risk.

4.2. Effect of CSR Linked Compensation on the Impact of Vega on Firm Risk

Existing empirical literature generally finds a positive relation between vega and firm risk (e.g., Tufano, 1996; Guay, 1999; Rajgopal and Shevlin, 2002; Coles et al., 2006; Low, 2009). We predict that the negative impact of CSR linked compensation on firm risk mitigates some of the positive effect of vega. To test Hypothesis 2, we include an interactive term between CSR linked compensation and vega in the following equation:

$$Firm\ risk_{i,t+1} = a + b_1 \times vega_{i,t} + b_2 \times vega_{i,t} \times CSRComp_{i,t} + c \times CSRComp_{i,t} + d \times controls_{i,t} + e_{i,t+1} \quad (3)$$

We argue that the risk incentives brought by vega could differ when CSR linked compensation is included in the executive's pay structure. To account for the interactive effect between vega and CSR linked compensation in the instrumental variable regressions, we augment the baseline model in Table 4 by adding a second instrumental variable: the interaction of state-level constituency statutes variable and vega (e.g., Hutton et al., 2018). Columns (1) and (2) show the estimation of the first-stage regressions to estimate the predicted values of CSR linked compensation and the interaction with vega. As expected, the coefficient on CONSTITUENCY is positive and significant at the 1% level. The interaction term of vega and CONSTITUENCY is also positive and significant. The first-stage Cragg-Donald F statistics is 11.86, which indicates that the instruments used are not weak instruments.

Columns (3)-(6) of Table 5 present the second-stage regressions on the same four measures of firm risk. The coefficients on CSR linked compensation are negative and significant in three models, and the coefficients on vega are positive and significant in all four models. These results show that CSR linked compensation lowers firm risk, while vega provides incentives to increase firm risk. Consistent with our predictions, the coefficient on the interactive term is negative in all four models. The coefficient is significant at the 5% level in the models with Total Risk and CAPEX as the dependent variable, at the 10% level in the model with Idiosyncratic Risk, and at the 1% level in the model with ROA volatility. Overall, these results suggest that CSR linked compensation helps in mitigating some of the risk increasing effect of vega, and provide support to Hypothesis 2.

4.3. Effect of CSR Linked Compensation for Positive and Negative Deviations from Optimal Risk

We also examine the effect of CSR linked compensation on the positive and negative deviations from the optimal level of firm risk. Like Harjoto and Laksmana (2018) and Bargeron et al. (2010), we conduct this analysis by first estimating optimal level of risk by estimating the following model below,

$$\begin{aligned} Risk\ taking_{i,t+1} = \quad & a + b_1 \times SPINDEXRET_{i,t+1} + b_2 \times GDPGROWTH_{i,t+1} \\ & + b_3 \times ROA_{i,t} + b_4 \times MB_{i,t} + b_5 \times LEV_{i,t} + e_{i,t+1} \end{aligned} \quad (4)$$

Where SPINDEXRET is the annual return on the S&P 500 Index and GDPGROWTH is US GDP percent growth based on current dollars. Since our models include data only after Sarbanes-Oxley Act, we exclude the POSTSOX variable that was included in the original model proposed by Bargeron et al. (2010). We estimate the above regression using our measures of total risk and idiosyncratic risk as dependent variables and then split sample based on positive and negative risk deviations.

To investigate whether the results obtained in the previous section would differ for firms with excessive risk taking (positive deviation) or excessive risk avoidance (negative deviation), we re-estimate the model in equation 3 for the subsamples comprising of positive and negative deviations. The results from the two-stage regressions are presented in Table 6. The results from first-stage regressions are similar and are not shown here to conserve space. The coefficient on the interaction term of CSR linked compensation and vega is negative and statistically significant at the 1% level only in the models in columns (1) and (3), where the sample includes positive deviations from optimal levels of risk. The coefficients on the interactive term presented in columns (2) and (4) are not statistically significant in the sample of negative deviations from risk in either measures of risk. The coefficients on vega is positive and statistically significant only in the sample of positive deviations from optimal risk, and is not significant in the sample of negative

deviation. These findings are consistent with Hypothesis 3 and suggest that CSR linked compensation mitigates the risk inducing effect of vega only when firms experience excessive risk taking. Overall, the results indicate that boards use CSR linked compensation to balance the excessive risk taking induced by option-based compensation.

4.4. Robustness Tests

The two-stage least squares methodology we employ in the previous sections addresses endogeneity concerns arising from omitted variables that may correlate with both CSR linked compensation and firm risk. To test the robustness of our empirical findings to other concerns, we also employ difference-in-differences (DiD) analysis and the propensity score matching regressions. The difference-in-differences (DiD) analysis addresses endogeneity concerns arising from unobservable variables that could lead to different levels of firm risk. The underlying assumption of our DiD model is that the change in the level of risk is the same for firms that pay executives CSR linked compensation and for firms that do not have this practice. In this model, we regress the difference of forward year's risk and current year's risk on the differences of current year and last year's values for all independent variables using the following model:

$$\Delta Firm\ risk_{i,t+1} = a + b \times \Delta CSRComp_{i,t} + c \times \Delta controls_{i,t} + e_{i,t+1} \qquad (5)$$

In this model, ΔCSRComp is equal to 0 if the firm did not change the its CSR linked compensation policy, is equal to 1 if the firm did not provide CSR linked compensation last year but adopted this practice this year, and is equal to -1 if the firm did pay executives CSR linked compensation last year but does not provide CSR linked compensation in the current year.

Table 7 presents the results of the difference-in-differences regressions where change in firm risk is the dependent variable. Columns (1) and (3) show that changes in the CSR linked

compensation policy has a significant impact on the changes in firm's levels of Total and Idiosyncratic risks. These results provide further support to Hypothesis 1. Columns (2) and (4) introduce the interaction term of the change in CSRComp and the change in vega. The coefficients on the interaction terms are negative and significant in both models, which provide additional support to Hypothesis 2.

As an additional robustness test, we also use the propensity score methodology (Rosenbaum and Rubin, 1983) to estimate the mitigating effect of CSR linked compensation on the relation between vega and firm risk. Table 8 presents results from the propensity score matching analysis. The matched sample analysis mitigates concerns about non-random selection by contrasting the treated group with a comparable set of controlled observations. Matching is based on the propensity score derived from the two logit models discussed in section 4.5. We use three matching algorithms: the standard one-to-one nearest neighbor, where each treated observation is paired with one match, the one-to-four nearest neighbors estimator, where each treated observation is paired with four matches, and the Kernel method, where each treated observation is paired with all the possible matches from our full sample, with the matches weighted according to the distances between matches' propensity scores and the treated observation's propensity score (Heckman et al., 1998). In the models used to generate paired firms, CSR is included among the control variables, and the average treatment effects of adopting CSR linked compensation shown in Table 8 is based on firms with comparable CSR performance. In the second logit model (in Panel B), we use risk incentives from option compensation as additional controls to pair observations, addressing the endogeneity concerns associated with vega.

In Panel A of Table 8, we generate matches for each treated observation using a logit model that studies the determinants of CSR linked compensation (e.g., Hong et al., 2016). For all three

matching approaches, the average treatment effects are significantly negative at the 1% level for both the total risk and the idiosyncratic risk measures. These results suggest a significant risk decreasing effect of CSR linked compensation on firm risk, based on comparable firm, board, and executive characteristics. The estimated range is between -0.0904 (for one-to-four nearest neighbors) and -0.0681 (for Kernel weighting) for total risk, which translates into an average of 1.08% reduction on total stock volatility. The estimates for idiosyncratic risk suggest an average of 1.09% reduction with CSR linked compensation, when comparing with otherwise similar observations without CSR linked compensation. In Panel B, we add two more controls, vega and delta from option compensation, to the logit model to measure the effect of CSR linked compensation on firm risk when vega and delta are comparable between treated and control observations. The significance level generally decreases, though still remains significant for all three matching approaches and for both risk measures. The negative effect is significant at the 10% level for total risk and at the 5% level for idiosyncratic risk with one-to-one nearest neighbor matching, and is significant at the 1% level for all other estimates. These results suggest an average of 1.05% drop in total risk and an average of 1.06% drop in idiosyncratic risk with the adoption of CSR linked compensation. Overall, both the difference-in-differences and the propensity score matching methods provide robustness to our primary empirical analysis.

4.5. CSR Linked Compensation and Vega

Previous studies on CSR linked compensation show that it provides incentives to managers to improve CSR performance (e.g., Hong et al., 2016; Maas, 2018; Flammer et al., 2019). Previous research also finds a negative link between CSR and firm risk (e.g. El Ghoul et al., 2011; Girerd-Potin et al., 2014; Ng and Rezaee, 2015; Harjoto and Laksmana, 2018). Our primary findings may also be explained by improved CSR performance. By linking managerial pay to social performance

boards induce executives to focus on long-term goals and influence firm risk orientation. In this case, CSR linked compensation may be more prevalent when incentives for risk taking are higher. To test if this is the case, we use the following logit model specification:

$$CSRComp_{i,t+1} = a + b_1 \times risk\ incentives_{i,t+1} + b_2 \times executive\ characteristics_{i,t} + b_3 \times board\ characteristics_{i,t} + c \times firm\ characteristics_{i,t} + e_{i,t+1} \quad (6)$$

Hong el al. (2016) find that firms with shareholder-friendly governance are more likely to provide incentives to their managers to engage in CSR. Following their model, we include variables that proxy for board independence and top executive's ownership and power. We also include variables to control for firm characteristics that are used in CSR and executive compensation literature. We include firm size and financial performance (Berrone and Gomez-Mejia 2009a, b), ROA (e.g., Deckop et al. 2006; Mahoney and Thorne 2005), leverage, R&D intensity, and advertising intensity (e.g., Jo and Harjoto, 2012). Since our analysis is at the executive level, we include an indicator variable to identify if the executive is the CEO. Additionally, we control for industry and year fixed effects.

Table 9 presents the results of the logit regressions of the decision of providing executives with CSR linked compensation on executive, governance and firm characteristics, and executive's risk incentives. The results indicate that our proxy for managerial power (executive is a director) is significantly negative, confirming the findings presented in Hong et al. (2016). We also confirm that board tenure significantly affects firm's decision to offer CSR linked compensation at the 1% significance level, and board size is significant at the 5% level. In column (2) we examine the effect of stock options included in executive compensation packages on the firm's decision to offer CSR linked compensation. We find that the coefficient on VEGA is positive and significant,

implying that executives with higher incentives for risk taking are more likely to receive CSR linked compensation. Marginal effects analysis shows that for the average manager, the likelihood of receiving CSR linked compensation package increases by 1.18% when the vega increases by one standard deviation ($115,660) from average value, holding all other variables at their mean. Given the sample average of 8% of managers receiving CSR linked compensation, we consider this 1.18% increase economically significant. This suggests that firms may use CSR linked compensation as a counterweight to incentives for risk-taking.

5. Conclusion

In this paper, we investigate if and how CSR linked compensation influences the relation between compensation incentives for risk taking (i.e. vega of executive compensation) and firm risk. We find that CSR linked compensation helps in mitigating the excessive risk taking induced by vega. Specifically, we find that CSR linked compensation reduces the positive impact of vega on measures of total and idiosyncratic risks when the deviation from optimal levels of risk is positive. However, when risk is below optimal level (i.e. the deviation from optimal level is negative), CSR linked compensation does not affect the positive effect of vega on firm risk. These findings indicate CSR linked compensation not only induces socially responsible investment and financial policies, it also provides boards with an effect tool to reduce the unintended excessive risk taking that results from incentives from option-based compensation.

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Table 1 Descriptive Statistics

VARIABLES	N	Mean	Median	Std. dev	5th percentile	95th percentile
Firm risk measures						
Total risk	20,935	0.020	0.018	0.008	0.010	0.035
Idiosyncratic risk	20,935	0.016	0.014	0.007	0.008	0.029
CAPEX	20,935	0.050	0.034	0.052	0.004	0.150
STDROA	20,935	0.314	0.183	0.393	0.021	1.329
Executive and corporate governance measures						
CSRComp	20,935	0.08	0	0.27	0	1
VEGA (000$)	20,935	58.23	15.54	115.66	0	281.51
OPTIONDELTA (000$)	20,935	93.51	23.32	193.55	0	458.81
CASHCOMP (000$)	20,935	633.63	510	450.85	242	1,368.33
CEO	20,935	0.22	0	0.41	0	1
CEOTENURE	20,935	8.80	7	7.21	1	23
BOARDSIZE	20,935	9.29	9	2.25	6	13
OUTSIDE	20,935	0.72	0.75	0.17	0.38	0.91
EXECDIR	20,808	0.32	0	0.47	0	1
SHROWN	20,808	0.45	0.07	1.53	0.00	1.71
OVER15	20,808	0.17	0.13	0.17	0	0.5
Firm measures						
SIZE (million$)	20,935	13,182	2,595	49,697	277	48,871
MB	20,935	2.06	1.64	1.37	0.98	4.59
GROWTH	20,935	0.085	0.072	0.176	-0.119	0.335
PPE	20,935	0.50	0.39	0.39	0.05	1.22
LEV	20,935	0.14	0.12	0.14	0	0.40
CSR	20,808	0.67	0	2.65	-2	6
ROA	20,808	0.06	0.06	0.08	-0.03	0.14
RD	20,808	0.04	0	0.11	0	0.13
AD	20,808	0.01	0	0.03	0	0.06

Table2 Correlations

	CSRComp	Total Risk	Idiosyncratic Risk	VEGA	OPTIONDELTA	SIZE	MB
CSRComp	1						
Total Risk	-0.1808*	1					
Idiosyncratic Risk	-0.1758*	0.9127*	1				
VEGA	0.1435*	-0.2114*	-0.2339*	1			
OPTIONDELTA	0.0914*	-0.1847*	-0.1894*	0.8703*	1		
SIZE	0.3262*	-0.4598*	-0.5022*	0.3990*	0.3173*	1	
MB	-0.0386*	-0.0546*	0.0004*	0.0597*	0.1823*	-0.2391*	1
LEV	0.0865*	-0.0125*	-0.0202*	0.0194	-0.0286*	0.3646*	-0.3877*
PPE	0.1686*	-0.0367*	-0.0180*	-0.0668*	-0.0894*	0.0910*	-0.1213*
GROWTH	-0.0317*	0.1761*	0.1392*	-0.0260*	0.0275*	-0.1015*	0.1643*
CASHCOMP	0.1784*	-0.1927*	-0.2037*	0.4622*	0.4219*	0.5028*	-0.0626*
CEO	-0.0061	0.0040	0.0044	0.3166*	0.3272*	-0.0102*	0.0016
CEOTENURE	-0.0658*	0.0831*	0.0881*	-0.0099	0.0293*	-0.1449*	0.0318*
OUTSIDE	0.0855*	-0.0879*	-0.1390*	0.0769*	0.0525*	0.1650*	-0.0237*
BOARDSIZE	0.1837*	-0.3242*	-0.3636*	0.2777*	0.2156*	0.6041*	-0.1166*

* denotes significance at 5% level.

Table2 Correlations - continued

	LEV	PPE	GROWTH	CASHCOMP	CEO	CEOTENURE	OUTSIDE	BOARDSIZE
LEV	1							
PPE	0.1815*	1						
GROWTH	-0.0812*	-0.0690*	1					
CASHCOMP	0.1645*	-0.0103*	-0.0601*	1				
CEO	-0.0043	-0.0121	0.0034	0.4565*	1			
CEOTENURE	-0.0553*	-0.0548*	0.0377*	-0.0307*	-0.0033*	1		
OUTSIDE	0.0062*	0.0382*	-0.0177*	0.0494*	0.0034	-0.0915*	1	
BOARDSIZE	0.1993*	0.0816*	-0.0969*	0.3486*	-0.0071*	-0.1779*	0.1229*	1

* denotes significance at 5% level.

Table 3 Univariate T test

	Mean(CSRComp=0)	Mean(CSRComp=1)	Difference	p-value
Total Risk	0.0206	0.0168	0.0038	<1%
Idiosyncratic Risk	0.016	0.0129	0.0031	<1%
VEGA	48.33	106.99	-58.66	<1%
CSR	0.51	2.07	-1.56	<1%
SHROWN	0.63	0.25	0.38	<1%
EXECDIR	0.29	0.27	0.02	2%
OVER15	0.18	0.13	0.05	<1%
OUTSIDE	0.71	0.77	-0.06	<1%
BOARDSIZE	9.32	10.77	-1.45	<1%
SIZE	14,826	77,044	-62,218	<1%

Table 4 - Firm risk and CSR linked compensation

This table presents results from two-stage least squares estimation. The result of the first stage is in column (1). The instrument is CONSTITUENCY. The results of the second stage are in columns (2) to (5) with different measures of firm risk. All independent variables are lagged. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	CSRComp	Total Risk	Idiosyncratic Risk	CAPEX	STDROA
CSRComp		-1.981***	-3.173***	-0.157***	-0.357**
		[0.000]	[0.000]	[0.000]	[0.024]
CONSTITUENCY	0.023***				
	[0.000]				
VEGA	0.274***	0.329**	0.699***	0.029**	0.175***
	[0.000]	[0.030]	[0.002]	[0.033]	[0.001]
OPTIONDELTA	-0.155***	-0.208***	-0.413***	-0.014**	-0.093***
	[0.000]	[0.010]	[0.001]	[0.049]	[0.002]
SIZE	0.046***	-0.034*	-0.011	0.006***	0.013*
	[0.000]	[0.077]	[0.700]	[0.001]	[0.076]
MB	0.011***	-0.009*	-0.003	0.005***	0.083***
	[0.000]	[0.086]	[0.750]	[0.000]	[0.000]
LEV	-0.094***	0.318***	0.278***	-0.029***	-0.132***
	[0.000]	[0.000]	[0.002]	[0.000]	[0.000]
PPE	0.060***	0.146***	0.232***	0.080***	0.024**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.024]
GROWTH	0.013	0.161***	0.215***	0.029***	-0.099***
	[0.212]	[0.000]	[0.000]	[0.000]	[0.000]
CASHCOMP	0.025***	0.095***	0.145***	0.007***	0.022***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
CEO	-0.016***	-0.057***	-0.089***	-0.005***	-0.015***
	[0.003]	[0.000]	[0.000]	[0.000]	[0.006]
CEOTENURE	-0.000	0.005	0.004	0.001	-0.006***
	[0.809]	[0.264]	[0.631]	[0.144]	[0.001]
OUTSIDE	0.029**	0.025	0.036	-0.001	-0.005
	[0.013]	[0.393]	[0.414]	[0.724]	[0.664]
BOARDSIZE	-0.018*	-0.070***	-0.121***	-0.017***	-0.047***
	[0.063]	[0.002]	[0.001]	[0.000]	[0.000]
Constant	-0.477***	-4.161***	-5.020***	-0.062**	-0.026
	[0.000]	[0.000]	[0.000]	[0.011]	[0.745]
Observations	20,935	20,935	20,935	20,935	20,935
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R2	0.171				

First stage Cragg-Donald F statistic	32.24

Table 5 - The effect of CSR linked compensation on firm risk through VEGA

This table presents results from two-stage least squares estimation. The results of the first stage are in column (1) and (2). Both CSRComp and the interaction term CSRComp*VEGA are instrumented. The instruments are CONSTITUENCY and an interaction term CONSTITUENCY*VEGA. The results of the second stage are in columns (3) to (6) with different measures of firm risk. All independent variables are lagged. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

VARIABLES	(1) CSRComp	(2) CSRComp_VEGA	(3) Total Risk	(4) Idiosyncratic Risk	(5) CAPEX	(6) STDROA
CSRComp			-1.430***	-2.426***	-0.100**	-0.134
			[0.002]	[0.001]	[0.024]	[0.542]
CSRComp*VEGA			-2.371**	-2.209*	-0.170**	-1.372***
			[0.025]	[0.100]	[0.036]	[0.005]
CONSTITUENCY	0.016***	-0.002***				
	[0.000]	[0.008]				
CONSTITUENCY*VEGA	0.077**	0.083***				
	[0.028]	[0.000]				
VEGA	0.158***	0.227***	0.756***	0.944**	0.055**	0.561***
	[0.000]	[0.000]	[0.005]	[0.012]	[0.015]	[0.000]
OPTIONDELTA	-0.137***	-0.045***	-0.206***	-0.350***	-0.010	-0.140***
	[0.000]	[0.000]	[0.001]	[0.001]	[0.121]	[0.000]
SIZE	0.051***	0.002***	-0.038*	-0.021	0.004**	-0.001
	[0.000]	[0.000]	[0.098]	[0.475]	[0.013]	[0.904]
MB	0.011***	-0.001**	-0.012*	-0.008	0.006***	0.076***
	[0.000]	[0.025]	[0.059]	[0.400]	[0.000]	[0.000]
LEV	-0.124***	-0.018***	0.232***	-0.079*	-0.021***	-0.138***
	[0.000]	[0.000]	[0.000]	[0.066]	[0.000]	[0.000]
PPE	0.081***	0.010***	0.117***	0.203***	0.080***	0.009
	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]	[0.467]
GROWTH	0.009	-0.000	0.185***	0.237***	0.029***	-0.131***
	[0.375]	[0.828]	[0.000]	[0.000]	[0.000]	[0.000]
CASHCOMP	0.023***	0.002***	0.082***	0.142***	0.007***	0.025***
	[0.000]	[0.010]	[0.000]	[0.000]	[0.000]	[0.000]

CEO	-0.012**	-0.010***	-0.065***	-0.099***	-0.006***	-0.031***
	[0.022]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
CEOTENURE	-0.003	-0.000	-0.004	-0.001	-0.000	-0.003
	[0.206]	[0.694]	[0.321]	[0.190]	[0.669]	[0.193]
OUTSIDE	0.032***	-0.000	-0.014	0.141	-0.006	0.006
	[0.006]	[0.866]	[0.631]	[0.111]	[0.300]	[0.632]
BOARDSIZE	-0.031***	-0.004**	-0.146***	-0.177***	-0.015***	-0.045***
	[0.001]	[0.033]	[0.000]	[0.000]	[0.000]	[0.000]
Constant	-0.546***	-0.023**	-3.842***	-4.792***	-0.046	0.092
	[0.000]	[0.015]	[0.000]	[0.000]	[0.100]	[0.424]
Observations	20,935	20,935	20,935	20,935	20,935	20,935
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
First stage Cragg-Donald F statistic	11.86	11.86				

Table 6 - CSR linked compensation and excessive firm risk

The table presents results from two-stage least squares estimation on excessive firm risk. First stage results are not reported. Subsample is captured by comparing actual risk level and the predicted risk level from the optimal risk models. All independent variables are lagged. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	Total Risk		Idiosyncratic Risk	
	(1)	(2)	(3)	(4)
VARIABLES	positive	negative	positive	negative
CSRComp	0.010	-0.034	-0.770**	-7.135
	[0.270]	[0.119]	[0.027]	[0.157]
CSRComp*VEGA	-0.011***	-0.004	-4.402***	8.395
	[0.001]	[0.184]	[0.000]	[0.336]
VEGA	0.001***	0.001	0.453**	-0.832
	[0.002]	[0.275]	[0.025]	[0.623]
OPTIONDELTA	-0.000	-0.001	-0.010	-0.804
	[0.712]	[0.181]	[0.852]	[0.146]
SIZE	-0.001**	0.001	-0.063***	0.314
	[0.011]	[0.305]	[0.000]	[0.234]
MB	-0.000	0.000	-0.008	0.070
	[0.803]	[0.274]	[0.150]	[0.289]
LEV	0.012***	0.004***	0.419***	-0.387
	[0.000]	[0.000]	[0.000]	[0.390]
PPE	0.001	0.001*	0.011	0.288
	[0.576]	[0.089]	[0.758]	[0.180]
GROWTH	0.001*	-0.000	0.117***	-0.099
	[0.075]	[0.722]	[0.000]	[0.608]
CASHCOMP	0.001*	0.003*	0.037***	0.241*
	[0.051]	[0.073]	[0.000]	[0.092]
CEO	-0.001**	-0.001*	-0.025*	0.005
	[0.027]	[0.096]	[0.054]	[0.955]
CEOTENURE	-0.000	0.000	-0.004	0.013
	[0.127]	[0.452]	[0.457]	[0.555]
OUTSIDE	-0.000	0.005	-0.051	0.076
	[0.670]	[0.136]	[0.102]	[0.630]
BOARDSIZE	-0.001*	0.001	-0.090***	-0.242**
	[0.071]	[0.608]	[0.000]	[0.037]
Constant	0.034***	-0.011	-3.439***	-8.005***
	[0.000]	[0.614]	[0.000]	[0.007]
Observations	8,748	12,381	9,848	11,087
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 7 The effect of the change in CSR linked compensation policy on the change of firm risk

This table presents results from the difference-in-difference method. All independent variables are lagged. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
VARIABLES	ΔTotal Risk	ΔTotal Risk	ΔIdiosyncratic Risk	ΔIdiosyncratic Risk
ΔCSRComp	-0.052***	-0.053***	-0.058***	-0.057***
	[0.000]	[0.000]	[0.000]	[0.000]
ΔCSRComp*ΔVEGA		-0.826**		-1.273***
		[0.033]		[0.006]
ΔVEGA	-0.084	-0.083	-0.032	-0.022
	[0.158]	[0.162]	[0.654]	[0.761]
ΔOPTIONDELTA	-0.069**	-0.078***	-0.134***	-0.133***
	[0.012]	[0.004]	[0.000]	[0.000]
ΔSIZE	0.007	-0.020	-0.038**	-0.043***
	[0.595]	[0.115]	[0.013]	[0.005]
ΔMB	0.005*	0.003	0.000	0.002
	[0.089]	[0.296]	[1.000]	[0.661]
ΔLEV	-0.004*	-0.004*	0.001	-0.000
	[0.097]	[0.072]	[0.761]	[0.885]
ΔPPE	0.040	0.026	-0.011	0.011
	[0.158]	[0.307]	[0.754]	[0.727]
ΔGROWTH	0.010**	0.014**	0.032***	0.038***
	[0.048]	[0.017]	[0.000]	[0.000]
ΔCASHCOMP	0.011	0.011	0.023***	0.022***
	[0.118]	[0.120]	[0.006]	[0.008]
ΔCEO	0.008	0.010	0.005	0.006
	[0.501]	[0.393]	[0.709]	[0.683]
ΔCEOTENURE	-0.006**	-0.006**	-0.006*	-0.005*
	[0.030]	[0.038]	[0.075]	[0.091]
ΔOUTSIDE	0.028**	0.062	0.040***	0.088
	[0.017]	[0.194]	[0.004]	[0.121]
ΔBOARDSIZE	-0.004	-0.005	-0.021	-0.024
	[0.839]	[0.767]	[0.309]	[0.264]
Constant	-0.272***	-0.269***	-0.033	-0.031
	[0.000]	[0.000]	[0.451]	[0.467]
Observations	12,964	12,964	12,964	12,964
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R2	0.417	0.425	0.129	0.134

Table 8 - Matching results

This table presents matching results and shows average treatment effects of having CSR linked compensation for managers on firm risk. Matching is based on the propensity score derived from logit models discussed in section 4.5 and equation (6).

Panel A: Matching without stock option compensation

	Total Risk		Idiosyncratic Risk	
	Coefficient	t-statistic	Coefficient	t-statistic
Method	(1)	(2)	(3)	(4)
Nearest neighbor 1:1	-0.0900	-3.81	-0.1050	-4.32
Nearest neighbor 4:1	-0.0904	-5.95	-0.1020	-6.58
Kernel	-0.0681	-6.19	-0.0718	-6.35

Panel B: Matching with stock option compensation

	Total Risk		Idiosyncratic Risk	
	Coefficient	t-statistic	Coefficient	t-statistic
Method	(1)	(2)	(3)	(4)
Nearest neighbor 1:1	-0.0397	-1.75	-0.0465	-1.99
Nearest neighbor 4:1	-0.0532	-3.50	-0.0636	-4.08
Kernel	-0.0592	-5.24	-0.0636	-5.48

Table 9 - Determinants of CSR linked compensation

This table presents results of logit regression models on determination of CSR linked compensation. These two models are used to generate propensity score for matched sample analysis as discussed in section 4.4. All independent variables are lagged. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)
VARIABLES	CSRComp	CSRComp
VEGA		1.639***
		[0.000]
OPTIONDELTA		-1.147***
		[0.000]
SHROWN	-0.021	-0.015
	[0.449]	[0.589]
EXECDIR	-0.176**	-0.164*
	[0.050]	[0.070]
CEO	0.139	0.147
	[0.170]	[0.158]
OVER15	-1.004***	-0.961***
	[0.000]	[0.000]
OUTSIDE	0.641***	0.614***
	[0.002]	[0.004]
LOGBOARDSIZE	0.361**	0.365**
	[0.027]	[0.025]
CSR	0.041***	0.039***
	[0.000]	[0.000]
SIZE	0.665***	0.663***
	[0.000]	[0.000]
LEV	-0.493*	-0.522*
	[0.065]	[0.052]
RD	0.775***	0.814***
	[0.005]	[0.003]
AD	2.775***	3.070***
	[0.004]	[0.001]
ROA	-1.089**	-0.907*
	[0.024]	[0.064]
Constant	-11.145***	-11.122***
	[0.000]	[0.000]
Observations	20,808	20,808
Industry FE	Yes	Yes
Year FE	Yes	Yes

Appendix - Variable definitions

Firm risk measures	
Total Risk	The log transformation of the standard deviation of firm's daily stock returns for a certain year.
Idiosyncratic Risk	The log transformation of the standard deviation of residuals of firm's daily stock returns against Fama-French three factor model for a certain year.
CAPEX	Capital expenditure scaled by total assets.
STDROA	Standard deviation of past five years' industry adjusted ROA.
Executive characteristics	
CSRCOMP	A dummy variable equal to 1 if an executive's compensation is linked with CSR factors for a certain year and equal to 0 otherwise.
VEGA	The change of an executive's stock option's value for every 1% change in the volatility of the underlying stock for a certain year.
OPTIONDELTA	The change of an executive's stock option's value for every 1% change in the return of the underlying stock for a certain year.
CASHCOMP	The log transformation of the sum of an executive's salary and bonus in a given year.
CEO	A dummy variable equal to 1 if an executive is the CEO in that year and equal to 0 otherwise.
CEOTENURE	The log transformation of CEO tenure that corresponds to a certain firm-year for the executive's observation.
EXECDIR	A dummy variable equal to 1 if an executive is also a board member in a given year and equal to 0 otherwise.
SHROWN	The percentage of total shares owned as reported by an executive in a given year.
Corporate governance measures	
OUTSIDE	The percentage of outside board members in a given year.
OVER15	The percentage of board members that have served for over 15 years in a given year.
BOARDSIZE	The log transformation of the total number of all directors in a firm in a given year.
Firm characteristics	
CSR	The raw aggregate score (total strengths minus total concerns) from six dimensions (community, diversity, employee relations, human rights, environment, and product) in KLD database.
SIZE	The log transformation of firm's total assets.
ROA	Return on assets, defined as earnings before interest and taxes divided by assets.
LEV	Firm leverage, defined as total liabilities divided by market value.
AD	Total advertising expenses divided by total sales
MB	Market-to-book ratio, defined as market value divided by total assets.
GROWTH	Growth in annual sales over the prior years.
PPE	Total property, plant, and equipment divided by total assets.