Executive Compensation Linked to Corporate Social Responsibility and Firm Risk

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Abstract

This paper empirically examines the relation between corporate social responsibility (CSR) linked executive compensation and corporate risk. Results from OLS and firm fixed effects regressions show that CSR-linked compensation reduces both total and idiosyncratic risks and this reduction is mediated by an increase in CSR performance. Results also indicate that CSR-linked compensation reduces risk only when risk is above optimal level and has no significant effect when risk is below optimal levels. Additional tests show that CSR-linked compensation mitigates the positive effect of vega of executive compensation on risk. Overall, these results show that CSR-linked compensation not only increases CSR orientation of a firm but also helps in managing corporate risk levels.

1. Introduction

In recent years, corporations have been paying increasing attention to corporate social responsibility (CSR) and environmental, social and governance (ESG) performance. The Governance and Accountability Institute notes that 90% of the S&P500 companies published sustainability reports in 2019. This is a significant increase compared to 2011 when only 20% of the S&P500 companies published these reports.[1] Investors and other stakeholder are also requiring companies to be accountable for their social and environmental impacts. For example, in 2018 about 26 percent of all investment assets under professional management in the United States were assets managed under sustainable and responsible investing strategies.[2] Moreover, recent academic studies have documented a positive relation between corporate social performance and firm value (e.g. Ferrel et al., 2016; Sheikh 2018), which brings CSR activities to the forefront of the corporate world.

Although managers recognize the importance of CSR performance metrics, they may not have incentives to invest in CSR related activities. This is because CSR investments have long-term orientation and may not be appropriately priced by capital markets. Consequently, boards have started linking managerial pay to CSR performance targets to provide incentives to their managers to focus on CSR related activities. Flammer et al. (2019) report that there is an upward trend in CSR-linked compensation and CSR contracting has a positive effect on long-term orientation and corporate social performance. In this study, we argue that boards link managerial pay to encourage executives to invest in CSR. However, a positive byproduct of CSR-linked compensation is that it

[1] https://www.ga-institute.com/research-reports/flash-reports/2020-sp-500-flash-report.html
[2] 2018 Global Sustainable Investment Review, US SIF. Available at: https://www.ussif.org/files/GSIR_Review2018_3_28(2).pdf

also helps in managing corporate risk levels. Prior studies show that CSR creates moral capital and provides insurance like protection (Godfrey 2009; Luo and Battacharya, 2009), and reduces information asymmetry (Cai et al., 2016), cost of capital (Sharfman and Fernando, 2008; El Ghoul et al., 2011) and financing constraints (Cheng et al., 2014). Consequently, higher levels of CSR induced by CSR-linked compensation result in lower levels of risk. We therefore expect that CSR-linked compensation reduces firm risk and this reduction in risk is mediated by an increase in CSR.

Furthermore, we expect that the risk reduction effect of CSR-linked compensation on firm risk is more pronounced when risk is above value increasing optimal levels. When risk is below optimal levels, CSR-linked compensation may not have a significant relation with firm risk. Additionally, the risk reducing effect of CSR-linked compensation may also have implications for the risk inducing effect of option linked compensation. Since vega of CEO option compensation induces managers to increase firm risk, CSR-linked compensation may reduce the positive effect of vega on firm risk.

We test the above predictions by collecting a sample of US firms for the period 2010-2016. Our benchmark empirical results from OLS, industry and firm fixed effects regressions indicate that CSR-linked compensation is negatively related to both total and idiosyncratic risks. Further analysis shows that this reduction in risk is mediated by an increase in CSR performance. We then estimate deviations from optimal levels of risk to create high and low risk samples. High risk (low risk) equals 1 if risk deviations are within the top quartile (bottom quartile) in the industry-year group and 0 otherwise. Results from Logit regressions indicate that CSR-linked compensation is negatively associated with risk in high risk sample and has no significant effect in the low risk sample. These results indicate that CSR-linked compensation reduces firm risk only when it is value decreasing and is above the optimal levels. Additional results show that CSR-linked

compensation reduces the positive effect of vega of executive option compensation on total and idiosyncratic risks. Overall, we provide empirical evidence that shows that CSR-linked compensation not only leads to higher social performance but also helps in managing corporate risk levels.

We subject our empirical results to numerous robustness checks. Our benchmark regressions use OLS regressions with robust standard errors clustered at the firm level, and industry and firm fixed effect regressions. All regressions also include year controls. We also use two stage instrumental variable (IV-2SLS) regressions to mitigate concerns about potential endogeneity of CSR-linked compensation and find similar results. Our results do not change when we estimate first-order difference regressions or use the propensity score matching technique to address concerns about sample selection.

We make a few distinct contributions to the emerging literature on CSR-linked compensation (e.g., Hong et al., 2016; Maas, 2018; Flammer et al, 2019). First, we document that CSR-linked compensation reduces corporate risk and this risk reduction is mediated by an increase in CSR performance. Second, we show that CSR-linked compensation reduces corporate risk levels only when risk is above the value enhancing optimal level and does not affect risk if it is below optimal level. Third, we show that CSR-linked compensation reduces the positive effect of vega of executive compensation on firm risk and this effect is significant only when risk above value increasing optimal levels. In this respect, we contribute to the literature that examines the risk-taking effects of vega (e.g., Coles et al., 2006; Chakraborty et al., 2007).

The remainder of the study is organized as follows. Section 2 discusses prior literature to motivate hypothesis development. Section 3 describes the data and measurement of variables.

Section 4 outlines the empirical methodology and presents empirical results. Section 5 provides robustness checks of the empirical results and section 6 concludes.

2. Motivation and Hypotheses Development

2.1. CSR-linked Compensation

The emerging literature on CSR-linked compensation provides several reasons that may drive companies to link executive compensation to CSR targets. The biggest driver is the increasing importance of CSR activities brought to light by active investors and academic studies that find a positive impact of CSR on firm long-term value and survival. Corporate boards are responding to this change by linking executive compensation to CSR. Although managers recognize the importance of CSR, they may not invest in CSR activities for several reasons. First, CSR is a long-term investment (Nguyen et al., 2017) and its benefits may not accrue in the short run as it requires long periods to make an impact on environment, employee relations or eco-friendly products. As pointed out by Flammer et al. (2019), managers may prefer short term investments due to pressures from career concerns (Gibbons and Murphy, 1992), analysts' expectations of earnings (DeGroot et al., 1999) or response to incentives linked to short term targets. Second, capital markets may not properly value CSR investments because their effects may not be tangible and it takes a long time to see their impacts on firm value.

Consequently, boards may link managerial compensation to CSR targets to redirect managerial focus on long-term orientation. Boards may also use CSR-linked compensation to fulfill the expectations of investors and other stakeholders about the firm's CSR engagement and to establish legitimacy concerning their social and environmental performance (Bansal, 2005; Scott, 2008). Hong et al. (2016) argue that firms with strong corporate governance are more likely to provide

CSR-linked compensation and find that providing compensation incentives linked to CSR targets is an effective tool to increase social performance. Mass (2018), however, reports that quantitative (hard) CSR targets are more effective in CSR performance than soft, easy to manipulate targets. Ikram et al. (forthcoming) also find that better governed firms link managerial pay to social performance and that both objective and subjective CSR targets result in higher social performance. Flammer et al. (2019) document a positive association between CSR-linked compensation and long-term orientation. They also find that CSR-linked compensation leads to higher firm value and more green innovations.

2.2. CSR-linked compensation and firm risk

As discussed above boards link managerial pay to induce higher social performance. However, one positive side effect is that higher social performance also helps in managing corporate risk. The literature on CSR suggests that besides being a value increasing strategic investment (Kruger, 2015), CSR is also a risk management strategy. The stakeholder theory proposes that CSR firms earn the support of stakeholders that control resources needed by a firm. For example, CSR signals trust and increases perceived quality and customer loyalty (e.g., Luo and Bhattacharya, 2006; Bardos et al., 2020). Employment engagement increases when firms treat employees well (Flammer and Kacperczyk, 2016) and corporate reputation improves when companies invest in environment and their communities (Luo and Battacharya, 2009; Delmas and Pekovic, 2013; Henisz et al.., 2014). 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 it strengthens a firm's relationship with key stakeholders who control key resources used in production (Frooman 1999; Backhaus et al. 2002).

Prior studies argue that CSR provides insurance like protection in the event of poor performance and negative events and generates relational wealth through improved relations (Godfrey, 2005; Peloza, 2006; Godfrey et al., 2009). It 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). Furthermore, 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 high CSR firms are perceived as less risky by investors (Robinson et al., 2008; Starks, 2009; Luo and Battacharya, 2009; Oikonomou et al., 2012; Bouslah et al., 2013).

Empirical studies find that that CSR leads to a reduction in corporate risk taking (Godfrey et al., 2009; Chakraborty et al., 2019). Harjoto and Laksmana (2018) propose that CSR serves as a control mechanism to reduce deviations from optimal risk taking, which may lead to higher value creation. We argue that due to the risk reduction effect of CSR performance, CSR-linked compensation is expected to have a negative effect on corporate risk. This risk reduction effect is mediated by an increase in CSR performance. Moreover, if CSR serves as a control mechanism as pointed out by Harjoto and Laksmana (2018), we expect that CSR-linked compensation would have a negative effect on corporate risk only when risk is above the value increasing optimal level and may not have a significant effect on risk when risk is the below optimal level. These observations lead to the following hypotheses.

H1: CSR-linked compensation is negatively related to corporate risk.

H2: The negative relation between CSR-linked compensation and corporate risk is mediated by an increase in CSR performance.

H3: CSR-linked compensation is negatively related to corporate risk only when risk is above the optimal level.

2.4. CSR-linked compensation, vega, and firm risk

The level of corporate risk is also determined by risk taking incentives in executive compensation. Agency theory (Jensen and Meckling, 1976) argues that managers are risk averse and poorly diversified and avoid value increasing investments to reduce their exposure to firm risk. It suggests that linking managerial pay to option compensation encourages managers to increase firm risk. 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.

We argue that the risk decreasing effect from CSR-linked compensation also helps in managing excessive risk taking induced by option compensation. Specifically, we expect that CSR-linked compensation would reduce the positive effect of vega of option compensation on corporate risk. This leads to the following hypothesis:

H4: CSR-linked compensation decreases the effect of vega on corporate risk.

3. Data and variable measurement

3.1. Measuring CSR-linked Compensation

The data on CSR-linked compensation is extracted from Bloomberg for the years 2010 to 2016 for all companies included in the Russel 3000 index. This index comprises 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 the same for every firm, and most firms do not provide clear numeric goals for such criteria. For example, while American Express sets targeted employee diversity measures in advance, the compensation committee at Kohl's subjectively reviews their managers' social performance. We therefore use a firm-level indicator variable to flag the existence of CSR-linked compensation. This construction is in line with previous studies (e.g., Hong et al., 2016; Flammer et al., 2019). This variable indicates if the CEO of the company received CSR-linked compensation. To test the validity of this measure, we also manually collected data from the companies' proxy statements for the year 2015. This data was then compared against the Bloomberg data to check if the companies included in our measure of CSR-linked compensation offered CSR-linked compensation packages. Our classification matched the data downloaded from Bloomberg.

We collected data on CSR performance from MSCI ESG Research databased formerly KLD) rating and details about CEO compensation from Execucomp. The data on firm financials was extracted from Compustat and the board data came from GMI ratings. We then merged CSR-linked compensation data with all other data. the resulting sample has 7,059 firm-year observations for 1,382 unique firms for the period 2010-2016.

3.2. Measuring of Firm Risk

Previous studies on the relation between 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. Following these studies, we use two primary measures of firm risk in our study: total risk and idiosyncratic risk. Total risk is calculated as the standard deviation of monthly stock returns, over the past five years. Idiosyncratic risk is estimated as the standard deviation of the residuals from the Fama-French three-factor market model. We use the natural logarithm of both measures to treat possible skewness in these two measures. The data used to calculate stock returns are extracted from CRSP.

3.3. Measuring Corporate Social Responsibility

We use MSCI ESG Research database (formerly known as the KLD Research and Analytics) data to construct measures of CSR performance. 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.

3.4. Measuring vega of CEO option compensation

Option compensation motivates risk-averse CEOs 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 CEO wealth to stock price (delta), discouraging risk-averse CEOs 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. We measure vega of option compensation using the 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 a CEO'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 a CEO's stock options for a 1% change in the price of the underlying stock. Since both delta and vega are highly skewed, we follow prior literature and use the natural logarithm of both variables in our analysis.

3.5. Control Variables

We control for CEO, 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 (total liabilities plus market value of equity divided by total assets), leverage (total liabilities over total assets), growth in annual sales over prior year, and capital expenditure scaled

by total assets. These data are obtained from Compustat. All continuous variables are winsorized at the 1st and 99th percentile, to exclude outliers. 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 CEO's risk aversion, power in the company, and other factors that are likely to impact firms' investment policies and risk. Specifically, we include the logarithm of the CEO's cash compensation (CASHCOMP), the logarithm of the number of years of CEO tenure (CEOTENURE), and the CEO's stock ownership (SHROWN).

Finally, we include board characteristics and institutional ownership (INSTOWN) to control for corporate governance. We include percentage of independent directors (BRDIND), average number of years of board service for the company (BRDTENURE), and the number of directors in the board each 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 MSCI GMI Ratings.

3.6. Summary Statistics

Table 1 presents descriptive statistics for our sample. Details of the construction of each variable are provided in the Appendix. Our sample contains relatively large firms, as the mean and median total assets are $14.42 billion and $2.28 billion, respectively. The median firm has a market-to-book ratio of 1.68, and a debt ratio of 53%. The mean (median) firm total risk in our sample, as measured by the standard deviation of monthly returns over the recent five years, is 8% (7%) and idiosyncratic risk is 10% (9%).

About 9% of the firms in our sample provide CSR-linked compensation to their managers. Large firms are more likely to include CSR incentives in their executives' pay structures. In our sample, 23.94% of the S&P 500 firms adopt CSR-linked compensation over the 7-year period. Table 1 also shows that the CEOs included in our sample have relatively large equity incentives in their compensation packages. Statistics for the vega and delta of the CEO's 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 $109,750 ($35,416), 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 $484,269 ($202,707). The average (median) cash compensation (salary and bonus) received by an executive is $ 948,811 ($ 855,021). The mean (median) percentage of shares owned by a CEO in our sample is 1.54% (0.34%). On average, directors serve the board for about 9 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, CSR-linked compensation is negatively related with both measures of firm risk.

Table 3 reports the differences in means between firms that offer CSR-linked compensation to managers and those that do not for several of the variables of interest. Firms that provide CSR-linked compensation, compared with those do not, tend to be larger in size, have lower total and idiosyncratic risk, higher CSR performance, and more independent boards with shorter average tenure. For firms which provide CSR-linked compensation, CEOs tend to own less, and institutional investors tend to own more shares of the firm.

[Tables 1, 2 & 3 about here]

4. Empirical Methodology and Results

4.1. Effect of CSR-linked Compensation on Firm Risk – Baseline Regressions

To examine the relation between CSR-linked compensation and firm risk, we estimate a regression model that includes control variables for firm, CEO, and governance characteristics, as well as year and firm or industry fixed effects. The model has the following specification:

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

Where firm risk is the total risk and idiosyncratic risk and CSR compensation is a categorical variable that equals 1 if the CEO compensation is linked to CSR targets and 0 otherwise. We use OLS and firm fixed effects regressions. All coefficients are estimated with robust standard errors adjusted for heteroscedasticity (White, 1980) and are clustered at firm level (Petersen, 2009). At the firm level, we control for size, leverage, market-to-book, capital expenditure, and growth. At the CEO level we control for risk incentives included in the equity portfolio (vega and delta), cash compensation, and CEO tenure and ownership to proxy CEO power. We also control for board independence, tenure, and size, as well as institutional ownership.

Table 4 shows our first set of results. Specifications (1) and (2) present the regression results from year industry fixed effects controlled at SIC division level. As predicted, the coefficients on CSR-linked compensation are significantly negative for both total risk (1% significance level) and idiosyncratic risk (5% significance level). The calculated marginal effects demonstrate that for an average firm, total (idiosyncratic) risk reduces by 5.49% (3.51%) when CSR-linked compensation equals 1. The coefficients on the control variables are generally consistent with previous research. As expected, firm risk is negatively related to firm size, market-to-book ratio, and board independence. Also, vega is significantly positively related to both measures of firm risk.

Columns (3) and (4) present results from year and firm fixed effects regressions. These results also show a negative relationship between firm's providing CSR-linked compensation and measures of risk. The coefficients are also significant at 1% level for both risk measures. Marginal effects indicate that for an average firm, total (idiosyncratic) risk decreases by 8.94% (5.73%) for firms that provide CSR-linked compensation. The magnitude of reduction in risk higher than the industry fixed effects regressions. Columns (5) and (6) provide results from year, industry, and firm fixed effects regressions. These results also indicate robust negative relationship between CSR-linked compensation and firm risk. Overall, results in Table 4 provide support to hypothesis 1 and show that CSR-linked compensation leads to reduction in corporate risk levels.

[Table 4 about here]

4.2. The Mediation effect of CSR

Previous literature documents an improvement in CSR performance after the adoption of CSR-linked compensation (Hong et al., 2016; Flammer et al., 2019). We argue that the negative effect of CSR-linked compensation on corporate risk is mediated by higher CSR performance. To test whether the relationship between CSR-linked compensation and firm risk is mediated by an improvement in CSR performance, we conduct mediation analysis. This methodology has recently been applied by Ferris et al. (2017), Fedaseyeu et al. (2018) and Bardos et al. (2020). The analysis implies the following relations where CSR is the mediator:

$$Firm\ risk = i_1 + c \times CSRComp \quad (2)$$

$$CSR = i_2 + a \times CSRComp \quad (3)$$

$$Firm\ risk = i_3 + c \times CSRComp + b \times CSR \quad (4)$$

Following Bardos et al. (2020), we consider that partial mediation occurs if the effect of CSR-linked compensation on firm risk decreases when we include CSR in the model. The results are presented in Table 5. Columns (1) shows the effect of CSR-linked compensation on total risk and column (2) shows the effect when CSR is included in the specification. These equations have been jointly estimated. The estimated coefficient on CSR-linked compensation is negative and significant in column (1). In column (2) the coefficient on CSR-linked compensation remains negative and significant at the 10% level but is slightly lower compared to column (1). The test for difference in coefficients is significant at the 10% level. For Idiosyncratic risk, the significance of the coefficient on CSR-linked compensation decreases from 5% level to 10% level when we include CSR in the model, which is shown in columns (3) and (4). The test for the difference in coefficients is significant at the 1% level, which is an indication of the presence of mediation. These results show that the effect of CSR-linked compensation on firm risk is mediated by CSR performance and provide support to hypothesis 2.

[Table 5 about here]

4.3. Effect of CSR-linked Compensation on excess risk

Hypothesis 3 argues that CSR-linked compensation results in risk reeducation only when risk is above the optimal level. In this section, we examine the effect of CSR-linked compensation on positive and negative deviations from the optimal level of firm risk. Following Harjoto and Laksmana (2018) and Bargeron et al. (2010), we calculate optimal level of risk by estimating the following model:

$$Risk_{i,t+1} = a + b_1 \times SPINDEXRET_{i,t+1} + b_2 \times GDPGROWTH_{i,t+1} + b_3 \times ROA_{i,t} + b_4 \times MB_{i,t} + b_5 \times LEV_{i,t} + e_{i,t+1} \quad (5)$$

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 and then calculate residuals as the risk deviation. We flag an observation as high (low) risk if risk deviation is within the top (bottom) quartile in industry-year group. We then run logit regressions with high risk and low risk indicator variables as dependent variables and examine the effect of CSR-linked compensation.

Table 6 provides results from this specification. The coefficient on CSRComp is negative and significant for both High Total risk and High Idiosyncratic risk. However, these coefficients are not statistically at any acceptable level in Low Total Risk and Low Idiosyncratic risk. These results support hypothesis 3 by showing that CSR-linked compensation leads to risk reeducation only when risk is above the value increasing optimal level does not change risk when it is below the optimal level.

[Table 6 about here]

4.4.Effect of CSR-linked Compensation on the impact of vega on firm risk

Hypothesis 4 argues that CSR-linked compensation, due to its risk reduction effect, also have implications for the effect of vega on firm risk. Since vega induces managers to increase firm risk, CSR-linked compensation is expected to reduce the positive impact of vega on firm risk. To test if CSR-linked compensation affects the relation between vega and firm risk, we run the following equation by including an interactive term of CSR-linked compensation and vega:

$$Firm\ risk_{i,t+1} = a + b_1 \times vega_{i,t} + b_2 \times vega_{i,t} \times CSRComp_{i,t} + c \times CSRComp_{i,t} + d \times controls_{i,t} + e_{i,t+1} \quad (6)$$

The results are presented in Table 7. The coefficient on vega is positive and significant which shows that vega of option compensation induces higher risk taking. However, consistent with our predictions, the coefficient on the interactive term is negative and significant at the 1% level for both Total and Idiosyncratic risks, indicating that CSR-linked compensation reduces the effect of vega on corporate risk. Overall, the results in Table 7 support hypothesis 4 and show that CSR-linked compensation helps in mitigating the risk increasing effect of vega.

[Table 7 about here]

5. Robustness Tests

5.1. Instrumental Variable Regressions

While the inclusion of control variables and firm 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. To mitigate concerns about endogeneity of CSR-linked compensation, we use the instrumental variables two-stage least squares (IV/2SLS) approach.

We use a social capital county indicator variable and average CSR-linked compensation as instrumental variables. These two variables are based on the determinants that directly affect company's decision of providing CSR-linked compensation and are not expected to have a direct effect on firm risk. Jha and Cox (2015) find that firms from high social capital regions exhibit

higher CSR. We use the social capital of the county in which the firm headquarters are located as our first instrumental variable. Social capital is measured following the model developed by Rupasingha and Goetz (2008). Prior studies also indicate that CSR is predominantly influenced by industry characteristics (Brammer and Millington, 2006; Garcia-Castro et al, 2010). We include industry-state average CSR-linked compensation (excluding the firm from the observation) as our second instrument. We believe that these two instruments are not directly related with the risk profile of firms. The regression results presented in Table 8 show that these two instrumental variables statistically satisfy both the relevance requirement and the exclusion condition.

The first-stage regression results are shown in column (1) of Table 8. As can be seen, the coefficient on social capital is positive and significant at the 10% level and the coefficient on industry-state average CSR-linked compensation is positive and significant at the 1% level, indicating that both these variables are significantly positively related to the likelihood of firms adopting CSR-linked compensation. The first stage Cragg-Donald F statistic is 17.575 and is well above the critical value, which indicates that the two instruments together provide significant explanatory power and are strong instruments for CSR-linked compensation.

Columns (2) and (3) of Table 8 present results from the second-stage regressions. Consistent with our hypothesis, the coefficients on CSR-linked compensation are negative and significant for both total risk and idiosyncratic risk measures after controlling for year and firm fixed effects. The coefficient on Hansen J statistic (Hansen, 1982) is statistically insignificant in both total risk and idiosyncratic risk (p-value of 0.986 and 0.494), showing that the instruments used in the IV regression satisfy the exclusion condition. Overall, the results in Table 8 show that the CSR-linked compensation is significantly negatively related to firm risk.

[Table 8 about here]

5.2.First-order difference regressions

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 a first-order difference regression. This analysis addresses endogeneity concerns arising from unobservable variables that could lead to different levels of firm risk. The underlying assumption of our 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:

$$\Delta Firm\ risk_{i,t+1} = a + b \times \Delta CSRComp_{i,t} + c \times \Delta controls_{i,t} + e_{i,t+1} \qquad (2)$$

In this model, ΔCSRComp is equal to 0 if the firm did not change 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 9 presents the results of the first-order difference regressions where change in firm risk is the dependent variable. Columns (1) and (2) show that changes in the CSR-linked compensation policy have a significant negative impact on changes in firm's levels of Total and Idiosyncratic risks. These results provide further support to our main hypothesis.

[Table 9 about here]

5.3. Propensity score matching analysis

As an additional robustness test, we use the propensity score methodology (Rosenbaum and Rubin, 1983) to address concerns about sample selection. To derive the propensity score for matching, we first look at the determinants of CSR-linked compensation. Following Hong et al. (2016), we run the logit regression with CSR-linked compensation as the dependent variable, and corporate governance variables, including average board tenure (BRDTENURE) and percentage of board members hired before the CEO hire (% HIREBEFORECEO), variables that proxy for CEO power, including CEO tenure (CEOTENURE) and an indicator for whether the CEO is also a board member (CEOEXECDIR), number of block holders (NUMBLOCK), CSR ratings (CSR), and firm fundamentals (LEV, RD, AD, ROA, and SIZE). Consistent with Hong et al. (2016), we also find that board tenure reduces the likelihood of CSR-linked compensation. 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 and less value-enhancing decisions such as providing CSR contracting (Flammer et al. 2019). Similarly, stronger CEO power as proxied by CEO ownership significantly reduces the likelihood of CSR contracting. As expected, higher CSR rating is positively related to the chance of the firm offering CSR-linked compensation, which is consistent with previous finding (Hong et al. 2016).

Table 11 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 and compares otherwise similar observations with and without CSR-linked compensation. Matching is based on the propensity score derived from the logit model presented in Table 10. 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 (as in the logit model presented in Table 10), and the average treatment effects of adopting CSR-linked compensation shown in Table 11 are based on firms with comparable CSR performance, as well as other comparable corporate governance variables, CEO power variables, and firm fundamentals.

In Panel A of Table 11, we find that 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 CEO characteristics. The estimated range is between -0.073 (for one-to-four nearest neighbors) and -0.078 (for Kernel weighting) for total risk, which translates into an average of 7.35% proportional reduction on total stock volatility, when comparing with otherwise similar observations without CSR-linked compensation. In Panel B, we repeat the panel regression analysis from Table 4 based on one-to-one matched samples. We use our baseline regression including industry and year fixed effects. The coefficients of CSR-linked compensation are negative for both specifications, and significant at 5% level for total risk measure and at 10% level for idiosyncratic risk measure. Overall, both the first-order difference regressions and the propensity score matching methods provide robustness to our primary empirical analysis.

6. Conclusion

Boards link executive pay to CSR targets to redirect managerial focus to CSR activities. Although managers recognize the significance of CSR, they may lack incentives to commit resources to CSR

activities due to the long-term orientation of these investments. Although CSR-linked compensation results in higher CSR performance, it also indirectly impacts corporate risk levels because CSR is a risk management tool. The empirical results of this study document a negative impact of CSR-linked compensation on corporate risk and show that this negative effect is mediated by an increase in CSR performance. We also find that the risk reduction effect of CSR-linked compensation results in lower risk only when risk is above the optimal level. Moreover, CSR-linked compensation also helps in mitigating the positive effect of vega on firm risk. Overall, we provide empirical evidence of the risk management effect of CSR-linked compensation.

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Table 1 - Descriptive statistics

VARIABLES	N	Mean	Median	Std. dev	1st percentile	99th percentile
CSR Comp	7,059	0.09	0	0.28	0	1
Total Risk	7,059	0.08	0.07	0.05	0.03	0.22
Idiosyncratic risk	7,059	0.10	0.09	0.06	0.04	0.27
CEOVEGA	7,059	0.11	0.04	0.17	0	0.63
CEODELTA	7,059	0.48	0.20	0.70	0	3.04
SIZE	7,059	14415	2,280	79,385	98.41	203,105
MB	7,059	2.11	1.68	1.37	0.84	7.78
LEV	7,059	0.54	0.53	0.24	0.09	1.21
CAPEX	7,059	0.04	0.03	0.04	0	0.22
GROWTH	7,059	0.10	0.06	0.28	-0.41	1.17
CSR	7,059	0.87	0	2.27	-3	9
CEOCASHCOMP	7,059	0.95	0.86	0.55	0.03	3.34
CEOTENURE	7,059	8.76	7	7.30	1	34
CEOSHROWN	7,059	1.54	0.34	2.98	0	12.25
BRDTENURE	7,059	9.04	8.71	4.11	1.09	20
BRDIND	7,059	0.81	0.86	0.11	0.44	0.93
BRDSIZE	7,059	9.28	9	2.20	5	15
INSTOWN	7,059	0.82	0.85	0.17	0.28	1.16

Table 2 - Correlations

This table presents the correlations between the key variables that we use in this paper. The first row reports Pearson correlation coefficients, and the second row reports significance level. * denotes significance at the 5% level.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) CSR Comp	1.000									
(2) Total Risk	-0.125*	1.000								
(3) Idiosyncratic Risk	-0.114*	0.971*	1.000							
(4) CEOVEGA	0.105*	-0.183*	-0.196*	1.000						
(5) CEODELTA	0.056*	-0.149*	-0.145*	0.532*	1.000					
(6) SIZE	0.144*	-0.046*	-0.068*	0.146*	0.111*	1.000				
(7) CAPEX	0.124*	-0.016	0.010	-0.040*	0.046*	-0.033*	1.000			
(8) LEV	0.088*	-0.025*	-0.045*	0.114*	0.017	0.128*	-0.039*	1.000		
(9) MB	-0.038*	-0.045*	0.001	0.092*	0.255*	-0.076*	0.058*	-0.083*	1.000	
(10) GROWTH	-0.080*	0.176*	0.183*	-0.038*	0.037*	-0.044*	-0.035*	-0.070*	0.182*	1.000
(11) CSR	0.203*	-0.204*	-0.202*	0.361*	0.199*	0.193*	-0.024*	0.139*	0.036*	-0.092*
(12) CEOTENURE	-0.090*	0.021	0.026*	0.013	0.312*	-0.038*	-0.021	-0.131*	0.049*	0.025*
(13) CEOCASHCOMP	0.167*	-0.100*	-0.118*	0.347*	0.273*	0.287*	0.020	0.247*	-0.077*	-0.070*
(14) CEOSHROWN	-0.100*	0.093*	0.106*	-0.144*	0.334*	-0.066*	0.046*	-0.192*	0.055*	0.045*
(15) BRDTENURE	-0.073*	-0.105*	-0.120*	-0.006	0.108*	-0.057*	-0.002	-0.152*	0.007	-0.093*
(16) BRDSIZE	0.203*	-0.211*	-0.237*	0.319*	0.135*	0.226*	-0.002	0.337*	-0.139*	-0.120*
(17) BRDIND	0.136*	-0.112*	-0.129*	0.191*	-0.027*	0.082*	-0.023*	0.124*	-0.052*	-0.092*
(18) INSTOWN	-0.091*	-0.044*	-0.061*	0.019	-0.045*	-0.103*	0.003	-0.009	0.026*	0.009
	(0.000)	(0.000)	(0.000)	(0.117)	(0.000)	(0.000)	(0.831)	(0.465)	(0.030)	(0.432)

Table 2 – Correlations - continued

Variables	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(11) CSR	1.000							
(12) CEOTENURE	-0.103*	1.000						
(13) CEOCASHCOMP	0.225*	0.045*	1.000					
(14) CEOSHROWN	-0.167*	0.502*	-0.083*	1.000				
(15) BRDTENURE	-0.052*	0.416*	0.007	0.209*	1.000			
(16) BRDSIZE	0.375*	-0.139*	0.328*	-0.237*	-0.038*	1.000		
(17) BRDIND	0.207*	-0.160*	0.062*	-0.274*	-0.178*	0.199*	1.000	
(18) INSTOWN	-0.049*	-0.083*	0.001	-0.230*	-0.068*	-0.093*	0.221*	1.000

Table 3 - Univariate T test

	No CSR Comp Mean	With CSR Comp Mean	Difference	t value
Total Risk	.112	.088	.024	14.95
Idiosyncratic Risk	.093	.071	.022	14.95
SIZE	10992.063	70157.964	-59165.901	-24.75
CSR	.408	1.666	-1.258	-28.2
CEOSHROWN	1.43	.482	.948	12.75
BRDTENURE	8.425	7.773	.652	4.1
BRDIND	.783	.839	-.056	-13.15
INSTOWN	.729	.756	-.028	-3.5

Table 4 - Firm risk and CSR-linked compensation

This table presents results from OLS regressions. Columns (1) and (2) are regressions with year and industry fixed effects. Columns (3) and (4) are regressions with year and firm fixed effects. Columns (5) and (6) are regressions with year, industry, and firm fixed effects. Firm risk is measured by both total risk and idiosyncratic risk. Independent variables are lagged. Standard errors are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

VARIABLES	(1) Total Risk	(2) Idiosyncratic Risk	(3) Total Risk	(4) Idiosyncratic Risk	(5) Total Risk	(6) Idiosyncratic Risk
CSRComp	-0.084***	-0.061**	-0.109***	-0.072***	-0.108***	-0.070***
	[0.006]	[0.042]	[0.000]	[0.008]	[0.000]	[0.009]
CEOVEGA	0.004	0.002	0.030***	0.019***	0.030***	0.019***
	[0.363]	[0.589]	[0.000]	[0.000]	[0.000]	[0.000]
CEODELTA	-0.022***	-0.023***	-0.014***	-0.011**	-0.015***	-0.011***
	[0.000]	[0.000]	[0.002]	[0.010]	[0.001]	[0.008]
SIZE	-0.086***	-0.102***	-0.207***	-0.176***	-0.211***	-0.178***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
CAPEX	0.230	0.446**	-0.576***	-0.581***	-0.582***	-0.584***
	[0.270]	[0.041]	[0.000]	[0.000]	[0.000]	[0.000]
LEV	0.211***	0.186***	-0.015	0.096**	-0.014	0.097**
	[0.000]	[0.000]	[0.745]	[0.018]	[0.760]	[0.017]
MB	-0.034***	-0.026***	-0.044***	-0.038***	-0.043***	-0.038***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
GROWTH	0.116***	0.132***	0.159***	0.127***	0.160***	0.128***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
CEOTENURE	0.028**	0.030***	-0.012	-0.012	-0.012	-0.012
	[0.011]	[0.009]	[0.192]	[0.156]	[0.219]	[0.175]
CEOCASHCOMP	0.002	0.000	-0.002	-0.000	-0.002	-0.000
	[0.869]	[0.987]	[0.844]	[0.963]	[0.868]	[0.987]
CEOSHROWN	0.009***	0.010***	0.008*	0.006	0.007*	0.006
	[0.006]	[0.003]	[0.067]	[0.122]	[0.079]	[0.137]
BRDTENURE	-0.015***	-0.019***	-0.012***	-0.010***	-0.012***	-0.010***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
BRDSIZE	-0.014***	-0.018***	-0.006	-0.005	-0.006	-0.005
	[0.001]	[0.000]	[0.161]	[0.214]	[0.165]	[0.209]
BRDIND	-0.294***	-0.378***	-0.281***	-0.194***	-0.277***	-0.192***
	[0.000]	[0.000]	[0.000]	[0.005]	[0.000]	[0.005]
INSTOWN	0.118**	0.060	-0.402***	-0.329***	-0.398***	-0.326***
	[0.026]	[0.286]	[0.000]	[0.000]	[0.000]	[0.000]
Constant	-1.174***	-1.108***	0.032	-0.646***	0.191	-0.500***
	[0.000]	[0.000]	[0.838]	[0.000]	[0.273]	[0.001]
Observations	7,058	7,058	7,058	7,058	7,058	7,058
Adjusted R square	0.383	0.372	0.232	0.179	0.237	0.182
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	No	No	Yes	Yes
Firm FE	No	No	Yes	Yes	Yes	Yes

Table 5 - Mediation analysis

This table shows the results of mediation analysis. Columns (1) and (3) show the effect of CSR compensation on firm risk. These are the same as the columns (1) and (2) in Table 4. Columns (2) and (4) show the effect when CSR is also included. The last row shows the p-value for the seemingly unrelated estimation test that the coefficient estimates for CSR compensation in the two specifications with the same risk measures are significantly different from each other. All models include year and industry fixed effects. Standard errors are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
VARIABLES	Total Risk	Total Risk	Idiosyncratic Risk	Idiosyncratic Risk
CSRComp	-0.084***	-0.079***	-0.061**	-0.055*
	[0.006]	[0.009]	[0.042]	[0.064]
CSR		-0.010***		-0.008**
		[0.004]		[0.033]
CEOVEGA	0.004	0.005	0.002	0.003
	[0.363]	[0.269]	[0.589]	[0.484]
CEODELTA	-0.022***	-0.021***	-0.023***	-0.022***
	[0.000]	[0.000]	[0.000]	[0.000]
SIZE	-0.086***	-0.080***	-0.102***	-0.099***
	[0.000]	[0.000]	[0.000]	[0.000]
CAPEX	0.230	0.203	0.446**	0.447**
	[0.270]	[0.329]	[0.041]	[0.030]
LEV	0.211***	0.202***	0.186***	0.170***
	[0.000]	[0.000]	[0.000]	[0.000]
MB	-0.034***	-0.032***	-0.026***	-0.028***
	[0.000]	[0.000]	[0.000]	[0.000]
GROWTH	0.116***	0.114***	0.132***	0.134***
	[0.000]	[0.000]	[0.000]	[0.000]
CEOTENURE	0.028**	0.027**	0.030***	0.030***
	[0.011]	[0.013]	[0.009]	[0.009]
CEOCASHCOMP	0.002	0.002	0.000	0.000
	[0.869]	[0.860]	[0.987]	[0.995]
CEOSHROWN	0.009***	0.009***	0.010***	0.009***
	[0.006]	[0.008]	[0.003]	[0.005]
BRDTENURE	-0.015***	-0.015***	-0.019***	-0.019***
	[0.000]	[0.000]	[0.000]	[0.000]
BRDSIZE	-0.014***	-0.013***	-0.018***	-0.017***
	[0.001]	[0.004]	[0.000]	[0.000]
BRDIND	-0.294***	-0.275***	-0.378***	-0.370***
	[0.000]	[0.000]	[0.000]	[0.000]
INSTOWN	0.118**	0.106**	0.060	0.053
	[0.026]	[0.045]	[0.286]	[0.349]
Constant	-1.174***	-1.249***	-1.108***	-1.156***
	[0.000]	[0.000]	[0.000]	[0.000]
Observations	7,058	7,058	7,058	7,058
Adjusted R square	0.383	0.387	0.372	0.375
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Coefficient test p-value	0.0783		0.0247	

Table 6 - The effect of CSR compensation on firm risk, for high and low risk

This table presents logit regression results of CSR-linked compensation on high risk versus low risk. First, the optimal risk model is estimated. Then, residual term is calculated as the risk deviation. An observation is flagged as high risk if risk deviation is within the top quartile in industry-year group. An observation is flagged as low risk if risk deviation is within the bottom quartile in industry-year group. Independent variables are lagged. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
VARIABLES	High Total Risk	Low Total Risk	High Idiosyncratic Risk	Low Idiosyncratic Risk
CSRComp	-0.405**	0.079	-0.423**	0.008
	[0.024]	[0.457]	[0.026]	[0.942]
CEOVEGA	-0.021	0.056***	-0.007	0.070***
	[0.335]	[0.001]	[0.737]	[0.000]
CEODELTA	-0.113***	0.067***	-0.090***	0.089***
	[0.000]	[0.004]	[0.000]	[0.000]
SIZE	-0.466***	0.515***	-0.551***	0.554***
	[0.000]	[0.000]	[0.000]	[0.000]
CAPEX	-0.327	-3.543***	0.141	-5.466***
	[0.741]	[0.000]	[0.886]	[0.000]
LEV	3.899***	-2.603***	3.504***	-3.208***
	[0.000]	[0.000]	[0.000]	[0.000]
MB	0.032	0.136***	0.016	0.095***
	[0.256]	[0.000]	[0.577]	[0.000]
GROWTH	0.682***	-0.448***	0.615***	-0.791***
	[0.000]	[0.002]	[0.000]	[0.000]
CEOTENURE	0.111*	-0.159***	0.071	-0.161***
	[0.059]	[0.001]	[0.235]	[0.001]
CEOCASHCOMP	0.153***	0.095*	0.157***	0.063
	[0.003]	[0.057]	[0.003]	[0.220]
CEOSHROWN	0.034**	-0.002	0.033**	-0.013
	[0.010]	[0.856]	[0.013]	[0.309]
BRDTENURE	-0.086***	0.081***	-0.099***	0.105***
	[0.000]	[0.000]	[0.000]	[0.000]
BRDSIZE	-0.025	-0.006	-0.039*	0.022
	[0.240]	[0.721]	[0.078]	[0.208]
BRDIND	-0.242	0.636**	-0.479	0.939***
	[0.477]	[0.040]	[0.164]	[0.003]
INSTOWN	-0.736***	-0.342*	-0.933***	-0.014
	[0.000]	[0.079]	[0.000]	[0.945]
Constant	2.478**	-8.150***	4.492***	-9.095***
	[0.038]	[0.000]	[0.000]	[0.000]
Observations	6,936	6,936	6,936	6,936
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Pseudo R square	0.145	0.146	0.163	0.181

Table 7 - How CSRComp affects the effect of VEGA

This table presents results from firm fixed effects regressions, on how the existence of CSRComp could affect the risk-promoting effect of vega on firm risk. Columns (1) and (2) show the results of regressions where an interactive term of CSRComp and vega is included. All models include year and firm fixed effects. Independent variables are lagged. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)
VARIABLES	Total Risk	Idiosyncratic Risk
ESGComp	-0.054**	-0.018
	[0.027]	[0.426]
CEOVEGA	0.032***	0.022***
	[0.000]	[0.000]
ESGComp*CEOVEGA	-0.019***	-0.018***
	[0.001]	[0.001]
CEODELTA	-0.014***	-0.011***
	[0.000]	[0.000]
SIZE	-0.206***	-0.174***
	[0.000]	[0.000]
CAPEX	-0.600***	-0.604***
	[0.000]	[0.000]
LEV	-0.018	0.093***
	[0.548]	[0.001]
MB	-0.043***	-0.038***
	[0.000]	[0.000]
GROWTH	0.159***	0.126***
	[0.000]	[0.000]
CEOTENURE	-0.012*	-0.012*
	[0.062]	[0.051]
CEOCASHCOMP	-0.001	0.000
	[0.865]	[0.980]
CEOSHROWN	0.008***	0.007***
	[0.003]	[0.009]
BRDTENURE	-0.013***	-0.010***
	[0.000]	[0.000]
BRDSIZE	-0.006**	-0.005*
	[0.047]	[0.072]
BRDIND	-0.277***	-0.191***
	[0.000]	[0.000]
INSTOWN	-0.406***	-0.333***
	[0.000]	[0.000]
Constant	0.014	-0.664***
	[0.884]	[0.000]
Observations	7,058	7,058
R-squared	0.235	0.183
Number of id	1,382	1,382
Year FE	Yes	Yes
Firm FE	Yes	Yes

Table 8 - Firm risk and CSR compensation - IV/2SLS regressions

This table presents results from two-stage least squares estimation. The result of the first stage is in column (1). CSRComp is endogeneized by the instrumental variables social capital at county level and state-year average CSRComp (excluding the firm in the observation). The results of the second stage are in columns (2) and (3) with two measures of firm risk. Independent variables are lagged. Firm and year fixed effects are included in all specifications. Standard errors are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
VARIABLES	ESGComp	Total Risk	Idiosyncratic Risk
CSRComp		-3.901***	-2.650***
		[0.001]	[0.001]
SOCIALCAP	0.020**		
	[0.031]		
AVG_CSRComp	0.469***		
	[0.000]		
CEOVEGA	-0.009***	-0.011	-0.009
	[0.000]	[0.508]	[0.472]
CEODELTA	0.002	-0.004	-0.004
	[0.463]	[0.693]	[0.574]
SIZE	-0.009	-0.211***	-0.179***
	[0.289]	[0.000]	[0.000]
CAPEX	-0.270***	-1.832***	-1.422***
	[0.006]	[0.007]	[0.003]
LEV	-0.020	-0.042	0.076
	[0.392]	[0.675]	[0.306]
MB	0.007**	-0.010	-0.015
	[0.025]	[0.608]	[0.288]
GROWTH	-0.008	0.100***	0.087***
	[0.363]	[0.010]	[0.002]
CEOTENURE	-0.003	-0.023	-0.019
	[0.495]	[0.344]	[0.286]
CEOCASHCOMP	0.007	0.021	0.016
	[0.264]	[0.550]	[0.546]
CEOSHROWN	-0.000	0.003	0.003
	[0.806]	[0.739]	[0.664]
BRDTENURE	-0.002	-0.019**	-0.015**
	[0.169]	[0.022]	[0.011]
BRDSIZE	-0.004*	-0.020	-0.015
	[0.076]	[0.233]	[0.201]
BRDIND	0.030	-0.107	-0.068
	[0.472]	[0.573]	[0.620]
INSTOWN	0.054**	-0.105	-0.128
	[0.050]	[0.542]	[0.294]
Constant	0.117	0.133	-0.577**
	[0.118]	[0.736]	[0.043]
Observations	6,889	6,889	6,889
R-squared	0.022		
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

First stage Cragg-Donald F statistic	21.009		
Hansen J statistic		0.008	0.311
p-value		0.9268	0.5771

Table 9 - Firm risk and CSR-linked compensation - first-order difference regressions

This table presents first-order difference regressions with ΔTotal Risk and ΔIdiosyncratic Risk as dependent variables. In both specifications, ΔCSRComp is equal to one if a firm adopts CSR-linked compensation in a given year and did not do so in the prior year, equal to minus one if a firm does not provided CSR-linked compensation in a given year and did so in the prior year, and equal to 0 otherwise. All other controls are the same as in Table 4, but measured in first-order differences compared with values in the prior year. Independent variables are lagged. Year and industry fixed effects are included. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)
VARIABLES	ΔTotal Risk	ΔIdiosyncratic Risk
ΔCSRComp	-0.019**	-0.019*
	[0.045]	[0.067]
ΔCEOVEGA	0.001	0.002
	[0.518]	[0.284]
ΔCEODELTA	-0.002	-0.004**
	[0.127]	[0.020]
ΔSIZE	0.004	-0.005
	[0.641]	[0.600]
ΔCAPEX	-0.166***	-0.094
	[0.008]	[0.168]
ΔLEV	0.101***	0.107***
	[0.000]	[0.000]
ΔMB	0.001	0.001
	[0.781]	[0.627]
ΔGROWTH	-0.007	-0.001
	[0.146]	[0.847]
ΔCEOTENURE	0.000	-0.000
	[0.899]	[0.988]
ΔCEOCASHCOMP	0.003	0.002
	[0.355]	[0.494]
ΔCEOSHROWN	0.001	0.002
	[0.690]	[0.272]
ΔBRDTENURE	0.001	0.000
	[0.620]	[0.987]
ΔBRDSIZE	0.001	-0.000
	[0.530]	[0.836]
ΔBRDIND	0.032	0.022
	[0.268]	[0.489]
ΔINSTOWN	0.004	0.007
	[0.842]	[0.779]
Constant	0.004	-0.014
	[0.906]	[0.724]
Observations	6,064	6,064
R-squared	0.231	0.220
Year FE	Yes	Yes
Industry FE	Yes	Yes

Table 10 - Matching results

This table presents matching results and shows average treatment effects on the treated of having CSR compensation on firm risk. Matching is based on the propensity score derived from the logit model presented in Table 7. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A – Average treatment effect

	Total risk		Idiosyncratic risk	
	Coefficient	t-statistic	Coefficient	t-statistic
Method	(1)	(2)	(3)	(4)
Nearest neighbor 1:1	-0.077	-3.02	-0.078	-3.00
Nearest neighbor 4:1	-0.073	-3.38	-0.067	-3.10
Kernel	-0.078	-3.95	-0.076	-3.84

Panel B - Regression based on nearest neighbor 1:1 matched sample

	(1)	(2)
VARIABLES	Total Risk	Idiosyncratic Risk
CSRComp	-0.045**	-0.035*
	[0.023]	[0.085]
CEOVEGA	0.008	0.003
	[0.101]	[0.515]
CEODELTA	-0.019**	-0.024***
	[0.029]	[0.007]
SIZE	-0.093***	-0.101***
	[0.000]	[0.000]
CAPEX	-0.205	-0.153
	[0.395]	[0.535]
LEV	0.082	0.083
	[0.157]	[0.162]
MB	-0.066***	-0.056***
	[0.000]	[0.000]
GROWTH	0.193***	0.225***
	[0.000]	[0.000]
CEOTENURE	0.008	0.008
	[0.663]	[0.649]
CEOCASHCOMP	0.003	-0.007
	[0.872]	[0.673]
CEOSHROWN	0.012**	0.009
	[0.046]	[0.154]
BRDTENURE	-0.024***	-0.025***
	[0.000]	[0.000]
BRDSIZE	-0.004	-0.006
	[0.475]	[0.325]
BRDIND	-0.724***	-0.728***
	[0.000]	[0.000]
INSTOWN	0.163**	0.076
	[0.014]	[0.262]
Constant	-0.929***	-0.910***
	[0.000]	[0.000]
Observations	1,195	1,195
R-squared	0.451	0.420
Year FE	Yes	Yes
Industry FE	Yes	Yes

Appendix - Variable definitions

Firm risk measures	
Total Risk	The log transformation of the standard deviation of a firm's monthly stock returns over five years.
Idiosyncratic Risk	The log transformation of the standard deviation of residuals of a firm's monthly stock returns against Fama-French three factor model over five years.
Executive characteristics	
CSRComp	A dummy variable equal to 1 if a firm is offering CSR-linked compensation for a certain year and equal to 0 otherwise.
CEOVEGA	The change of a CEO's stock option's value for every 1% change in the volatility of the underlying stock for a certain year.
CEODELTA	The change of a CEO's equity portfolio's value for every 1% change in the return of the underlying stock for a certain year.
CEOCASHCOMP	The log transformation of the sum of a CEO's salary and bonus in a given year.
CEOTENURE	The log transformation of CEO tenure in a given year.
CEOEXECDIR	A dummy variable equal to 1 if a CEO is also a board member in a given year and equal to 0 otherwise.
CEOSHROWN	The percentage of total shares owned as reported by a CEO in a given year.
NUMBLOCK	Number of block holders who own at least 5% of the firm in a given year.
Corporate governance measures	
BRDIND	The percentage of independent directors on board in a given year.
BRDTENURE	The average tenure of directors on board in a given year.
BOARDSIZE	The total number of all directors on board in a firm in a given year.
INSTOWN	The percentage of institutional investor ownership in a firm in a given year.
%HIREBEFORECEO	The percentage of directors that are hired before the CEO hire.
Firm characteristics	
SIZE	The log transformation of firm's total assets.
LEV	Firm leverage, defined as total liabilities divided by total assets.
CAPEX	Capital expenditure minus sales of property scaled by total assets.
MB	Market-to-book ratio, defined as market value divided by book value of total assets.
GROWTH	Growth in annual sales over the prior years.
RD	Total research and development expenses divided by total sales
AD	Total advertising expenses divided by total sales
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.
ROA	Return on assets, defined as net income divided by total assets.