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Corporate Social Responsibility and CEO Risk-Taking Incentives

Zhichuan Li

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CEO risk-taking incentives and corporate social responsibility

Craig Dunbar, Zhichuan (Frank) Li*, Yaqi Shi

Ivey Business School, Western University, Canada

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ABSTRACT

We examine how firms adjust CEO risk-taking incentives in response to risk environments associated with their corporate social responsibility (CSR) standing. We find strong evidence that as a firm's CSR status improves (declines), increasing (decreasing) its risk-taking capacity, the firm responds by adjusting compensation contracts to increase (decrease) CEO risk-taking incentives (Vega). One channel of the adjustment is through stock option grants. Further analyses indicate that the positive CSR-Vega association is stronger in firms with better corporate governance and in industries where riskiness is more important. Our evidence indicates that firms are not passive in response to changes in CSR status and firm risk.

1. Introduction

Stock option-based compensation is argued to give managers incentives to take risks. The literature (e.g., Guay, 1999; Coles et al., 2006; Armstrong and Vashishtha, 2012) consistently shows a significantly positive relation between Vega, the sensitivity of CEO wealth to stock return volatility which arises from stock option compensation, and measures of firm risk. More recent studies suggest a causal link between Vega and risk where CEO option Vega is shown to drive decisions leading to riskier firm policies and higher firm risk (e.g., Chava and Purnanandam, 2010; Shue and Townsend, 2017). As noted by Gormley et al. (2013), however, very little is known regarding how firms establish and adjust risk taking incentives provided to CEOs via options. Several studies argue that option granting should be affected by a firm's risk environment (e.g., Edmans and Gabaix, 2011). However, firms, through proxy filings, provide little guidance on how Vega is set or adjusted.[1] In this study, we attempt to contribute to the understanding of how managerial risk-taking incentives are established and adjusted by studying how a firm's Corporate Social Responsibility (CSR) standing affects risk taking incentives provided to a CEO through their option-based compensation. Formally, we examine how CSR standing affects CEO option Vega.

For there to be a plausible connection between CSR standing and CEO Vega, we rely on the risk management theory in the CSR literature and the agency theory in the executive compensation literature, the two prevailing theories in each literature. First, CSR

* Corresponding author.
E-mail addresses: cdunbar@ivey.ca (C. Dunbar), fli@ivey.ca (Z.F. Li), yshi@ivey.ca (Y. Shi).

[1] While we find that adjustments to Vega through changes over time in option granting do occur, firms do not disclose reasons for such adjustments. As discussed later in the paper, Gormley et al. (2013) study adjustments intended to reduce risk taking following a negative event. There are no cases in their study where firms disclose the rationale behind compensation changes. This is because firms normally do not publicly disclose that they want the CEOs to undertake more risks, due to potential litigation risk concerns. If some risky investments destroy firm value, boards, CEOs and proxy firms are all legally liable. See "The Proxy Protection Racket", Wall Street Journal, Nov. 10. 2019 (https://www.wsj.com/articles/the-proxy-protection-racket-11573417818) for a discussion of this litigation risk concern. We are grateful to Todd Milbourn for discussions on firm disclosures in their study.

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standing must impact determinants of executive compensation structure so that changes to CSR could cause firms to revisit decisions regarding Vega. As discussed more below, extensive research shows a significant impact of CSR standing on firm risk (e.g., summarized in the survey by Orlitzky and Benjamin, 2001). Further, studies argue and find that CEO option granting is affected by a firm's risk environment (e.g., Edmans and Gabaix, 2011; Gormley et al., 2013). CSR, therefore, could conceivably impact decisions regarding Vega. Second, firms must be mindful of both their CSR standing and executive compensation and willing to actively adjust compensation incentives accordingly. CSR has emerged as an essential component of business life for many firms. On August 19, 2019, the Business Roundtable, an association of CEOs of America's largest companies, released a statement redefining the 'Purpose of a Corporation' as better serving everyone - customers, employees, community, suppliers and shareholders.[2] Enshrining CSR principles, the statement recognizes the importance of 'fair compensation'. Firms mindful of CSR should be mindful of CEO compensation. In April 2020, over 330 large public companies announced changes to CEO compensation as activists argued that reputational consequences from inaction on CEO compensation during the Covid-19 pandemic could be significant.[3] In a period of extreme business stress, action on CEO compensation was taken by a large number of public companies. Overall, therefore, we believe it is plausible that firms will set and adjust CEO option Vega recognizing CSR standing and its changes.

While evidence on the impact of CSR on *firm value* is mixed,[4] researchers provide strong and consistent evidence of a negative relation between CSR and firm risk (e.g., Orlitzky and Benjamin, 2001). Further, many studies demonstrate a more direct causal link. For example, Godfrey et al. (2009) show that firms with higher CSR standing face a more dampened market reaction to unexpected negative legal/regulatory actions than otherwise similar firms with lower CSR standing. There are two notable theories linking CSR and firm risk. First, Godfrey (2005) argues that CSR reduces firm risk by generating 'moral capital' to provide insurance-like protection for a firm's relation-based intangible assets, such as customer loyalty.[5] Second, Albuquerque et al. (2019) argue that CSR is a product differentiation investment, which leads to a lower price elasticity of demand. With a lower elasticity of demand, economic shocks have a less significant impact on firm performance, resulting in decreased firm risk.

Our primary hypothesis regarding the relation between CSR and Vega, the *risk capacity* hypothesis, argues that firms should respond to increasing (decreasing) CSR standing by increasing (decreasing) CEO risk-taking incentives, Vega. Like the carcinogenic status of a firm's chemicals, CSR status should affect what Gormley et al. (2013) refer to as "left-tail risk". Positive (negative) shocks to left-tail risks have a negative (positive) impact on the expected cash flows of the firm's investment opportunities.[6] When CSR improves (declines) and left-tail risk declines (increases), marginal projects will be more (less) attractive to shareholders. As a result, shareholders should want to provide risk-averse CEOs greater (less) incentive to pursue risky projects. Also, from the CEOs' perspective, options are less attractive when CSR status is low. Since left-tail risk increases in that setting, the undiversified CEOs should prefer lower financial exposure to the firms through option compensation (see Gormley et al., 2013).

We empirically examine implications of the *risk capacity* hypothesis. First, we estimate the relation between lagged CSR standing and CEO Vega using 24,496 US firm-year observations for 2610 firms from 1992 to 2016. Consistent with the extensive literature, we begin by using the MSCI ESG Stats (formerly KLD) database to adopt a single measure to capture overall CSR standing. We find strong support for a *positive* relation between lagged CSR status and CEO risk-taking incentives. Economically, the relation is quite significant. In our base model, a one standard deviation change in a firm's aggregate CSR score leads to 30.41 change in CEO Vega, equivalent to 25% of mean Vega.

Next, we explore *how* firms adjust CEO incentives in response to CSR status. One important mechanism firms can use to adjust Vega is option grants. Therefore, we examine the relation between CSR standing and CEO option grants. Consistent with our evidence on the CSR-Vega relation, we find a significantly positive relation between CSR standing and subsequent option grants. This supports the premise that firms actively adjust CEO incentives in response to their CSR standing.

While endogeneity concerns are common in studies like ours, we believe a significant benefit to our setting is that the positive relation we find for CSR and Vega is challenging to explain based on reverse causality. We posit that higher CSR standing drives compensation contracts with higher Vega. Instead, could CEO option Vega be the driver of CSR? Given the extensive literature introduced previously, we suspect not. Vega, which is intended to encourage risk taking, has proven to lead to increased firm risk; CSR standing has been shown to result in lower firm risk. Therefore, if anything, higher Vega should *discourage* CSR investments. A CEO compensated with high Vega should be biased toward riskier projects and, therefore, more likely to avoid CSR investments, all else equal.[7]

[2] See https://www.forbes.com/sites/amberjohnson-jimludema/2019/08/20/the-purpose-of-the-corporation/#75961a253846 and https://opportunity.businessroundtable.org/ourcommitment/

[3] See https://www.wsj.com/articles/companies-that-dont-cut-executive-pay-now-could-pay-for-it-later-11587477361

[4] Some studies empirically find a positive CSR-firm value relation (e.g., Hillman and Keim, 2001) while others find a negative one (Brammer et al., 2006). The studies exploring a negative CSR-firm value relation focus on agency theory (e.g., Hong et al., 2016) and misleading shareholders in a seasoned equity offering (SEO) setting (Dutordoir et al., 2018). Theories leading to a positive relation consider increased customer awareness (Servaes and Tamayo, 2013), labor productivity (Gong and Grundy, 2019), strategic CSR (Porter and Kramer, 2011), cash holdings (Chang et al., 2019) and risk management/insurance properties of CSR.

[5] Building on this, Lins et al. (2017) posit that CSR, encompassing civic engagement and cooperation between the firm and its stakeholders, can build social capital and trust that contribute to superior financial performance, especially during periods of stress.

[6] Consistent with this, Ferrell et al. (2016) find that CSR standing leading to lower risk drives higher firm valuation.

[7] We further note that a mechanical relationship between firm risk and Vega would also predict that high Vega should drive lower CSR. All else equal, when firm volatility increases, option Vega increases, based on the Black and Scholes (1973) model. As an increase in CSR standing results in lower firm risk, Vega should then decline mechanically. In sum, reverse causality arguments and the mechanical relationship both suggest a negative CSR-Vega relation. If anything, these considerations should bias *against* us finding a positive relation between CSR and Vega.

Even though in our setting reverse causality concerns are not likely to be important in theory, we perform Granger causality tests and confirm that there is no significant relation between lagged Vega and future CSR. To further reduce concerns regarding endogeneity, we employ an instrumental variables approach and find that our core results are unaffected.

To check the robustness of our core evidence, we develop and test extensions of the risk capacity hypothesis. First, we consider alternative definitions of CSR standing. When we separately consider the effect of CSR strengths and weaknesses, for example, the core relation holds. However, the effect of strengths on Vega is much stronger than weaknesses. As documented by Gormley et al. (2013), firms are sometimes slow to adjust CEO contracts in response to changes in a firm's risk environment. However, since positive CSR outcomes are more controllable and predictable than negative outcomes, Vega response to CSR strengths should be faster and stronger. Our second set of robustness tests consider the impact of CSR on Vega for subsets of firms that are likely to be different in terms of their sensitivity to risk and CSR. For firms where risk is expected to be more important or where CSR is expected to have a larger impact on risk, we find a stronger CSR-Vega, which is consistent with our *risk capacity hypothesis*.

Even though our evidence supporting the risk capacity hypothesis is strong, we recognize that alternative explanations for our findings are possible. Bebchuk and Fried (2003) argue that powerful CEOs set their own pay and prefer compensation schemes with more cash and fewer options. Powerful CEOs may also be inclined to invest little in CSR so they can expropriate more resources and consume more perquisites (e.g., El Ghoul et al., 2016). Taken together, the *entrenchment hypothesis* predicts a positive CSR-Vega relation only for firms with weak governance. Our *risk capacity* argument assumes that firms actively adjust executive compensation according to risk capacity created by CSR to enhance firm value. Therefore, we would expect the CSR-Vega relation to be, if anything, stronger in better-governed firms. We consider a variety of governance proxies and find that our results are consistent with the risk capacity but not the entrenchment hypothesis.

It is important to emphasize key differences between our research question and the questions considered in seemingly related recent studies. Flammer et al. (2019), for example, study CSR-incentives in CEO compensation contracts (see also Hong et al., 2016, and Ikram et al., 2019). They find that CEOs with CSR-linked compensation incentives pursue policies that result in stronger CSR outcomes. Although their study appears similar to ours in that they examine a relation between executive compensation and CSR outcomes, CSR contracts and Vega focus on very different incentives and have different goals. In addition, CSR contracts and Vega have little overlap in the CEO compensation structure in terms of the *form* of compensation. CSR-incentives are typically structured as bonuses. If the CEO meets certain CSR-related objectives, then they receive a bonus which is almost always in the form of cash or firm stock. Importantly, cash and stock have no impact on a CEO's Vega, which is the focus of our study. While as noted above, the Vega in option compensation encourages risk taking, cash and stock compensation have been shown to discourage it. Chava and Purnanandam (2010), for example, find that greater pay-for-performance incentives, or “delta”, arising from stock-based compensation causes CEOs to pursue policies that result in lower firm risk. Existing studies, therefore, provide little insight into our central research question: how CSR standing impacts the *risk-taking* incentives provided to CEOs.

Overall, we believe our study makes several contributions to the literature. First, we contribute to the executive compensation literature on how CEO compensation contracts evolve based on firms' risk environment. Gormley et al. (2013) find that a firm's board responds to positive risk shocks by decreasing CEO Vega. Our work complements that study by showing that firms respond to negative and positive changes in CSR-related risk environment by adjusting CEO Vega. Our study links the executive compensation literature and the CSR literature, and is the first to show that CSR standing affects executive risk-taking incentives.

Second, while the focus of our research is on executive incentives, our study also contributes to the large CSR literature. Much of that literature tests for the association between CSR standing and firm risk but does not consider the potential moderating effects of CEO incentives. Since firms respond to positive CSR outcomes by increasing risk-taking incentives, the existing literature likely *understates* the true risk-reducing effect of CSR, as CEO risk incentive adjustments partially undo the negative effect of CSR status on firm risk. We believe our study also makes a timely contribution to the debate on whether CSR is value maximizing. The mixed results in the large literature on the CSR-firm value relation may be driven by whether firms can identify and take actions to realize the economic benefits of CSR. “Doing good” alone is not sufficient for “doing well.” Based on our findings, to maximize shareholder value, firms should actively respond by increasing Vega to encourage CEOs to take advantage of the new risk capacity created by CSR.

Finally, we contribute to the corporate governance literature. While both boards and CEOs have an impact on the setting of executive compensation contracts, the effectiveness of board oversight is still unclear (e.g., Guthrie et al., 2012). Our evidence on corporate governance reveals that some forms of board control, represented by enhanced diversity and inclusion of a sustainability/CSR committee for example, provide effective mechanisms in setting CEO risk incentives.

The remainder of the paper is organized as follows. Section 2 reviews the literature and develops our hypotheses. Section 3 discusses our data sources and variable measurements. Section 4 presents our primary and robustness test results. Section 5 considers an alternative explanation for our findings, while Section 6 concludes with a discussion of the broader implications of our research.

2. Literature review and primary hypothesis development

2.1. CEO incentives and firm risk

Grounded in agency theory (Jensen and Meckling, 1976), economists argue that CEOs are inherently more risk-averse than optimal for organizations. CEOs have their “human capital” and wealth tied to their firms, being less diversified than shareholders. Consequently, they seek to avoid risks as poor firm performance can have a significant bearing on their wealth (Milgrom and Roberts, 1992). One solution to the “risk shirking” issue (Haubrich, 1994) is to give CEOs stock options. Options are argued to encourage risk-taking as their convex payoffs reward upside outcomes while having less or no downside effects. Prior research shows a significantly

positive relation between Vega, the sensitivity of CEO wealth to stock return volatility, and measures of firm risk (e.g., Guay, 1999; Coles et al., 2006; Armstrong and Vashishtha, 2012; Chen et al., 2014) and suggest that Vega is an effective tool for firms to encourage their executives to take risks. The literature finds a causal relation by studying exogenous shocks to Vega (e.g., Chava and Purnanandam, 2010; Gormley et al., 2013; Bakke et al., 2016; Shue and Townsend, 2017).[8]

2.2. CSR and firm risk

How CSR affects firm outcomes, from stock performance and valuation to corporate policies, has been extensively studied.[9] One important stream of work has focused on the impact of CSR standing on firm risk. Orlitzky and Benjamin's review paper (2001) notes that most studies find that CSR standing is significantly negatively associated with firm risk.

There are two primary theories linking CSR and firm risk. In line with stakeholder theory (see Freeman, 1984, and Jones, 1995), the risk management theory posits that CSR engenders positive relationship-based intangible assets, or moral capital, and provides the firm with insurance-like protection (Godfrey, 2005). Smith and Stulz (1985) and Stulz (2002) show that risk management adds value to shareholders when the "perfect" capital market assumption is violated in the real world. Specifically, risk management improves firm value by reducing any risks that would result in deadweight costs that cannot be diversified away by investors (e.g., bankruptcy costs).

Extending the theory that CSR serves as insurance against firm-specific idiosyncratic risk (Godfrey, 2005), Lins et al. (2017) propose that CSR generates social capital because it embraces civic engagement, shared beliefs, and trust between a firm and its stakeholders (also see Sapienza et al., 2013). Similarly, Borghesi et al. (2014) show that CSR investments are essentially part of an expansive strategy to create goodwill and form decent political relations. The concept of CSR generally refers to corporate policies and activities that serve people, communities, and the environment in ways that go beyond shareholder interests and legal requirements (McWilliams and Siegel, 2000 & McWilliams and Siegel, 2001). An OECD paper (Scrivens and Smith, 2013) defines social capital along four dimensions: 1) personal relationships; 2) social network; 3) civic engagement; 4) trust and cooperative norms. Thus, CSR can directly map into at least 3) civic engagement and 4) trust and cooperative norms of the social capital definition.

The second theory linking CSR and firm risk, developed by Albuquerque et al. (2019), is an industry equilibrium model where CSR is a technological investment to increase product differentiation. Product differentiation causes the firm to face relatively less-elastic demand, resulting in higher product prices and profit margins. The lower demand elasticity also results in lower firm risk as economic shocks have less effect on firm performance. In an equilibrium model, the negative effect of CSR on risk is greater when the firm's industry is characterized as having greater product differentiation, greater profit margins, and/or lower elasticity of demand.

The predicted negative effect of CSR standing on firm risk is supported by numerous empirical studies (Orlitzky and Benjamin, 2001; Lee and Faff, 2009; Jo and Na, 2012; Oikonomou et al., 2012; Kim et al., 2014; Jiraporn et al., 2014; Krüger, 2015). Many of them have attempted to show a causal link. For example, Godfrey et al. (2009) study the shareholder reaction to 178 unexpected negative legal/regulatory actions. They find that the market reaction to a negative event is much less negative for firms with higher CSR standing. Several recent papers use instrumental variables to support a causal relation (e.g., Albuquerque et al., 2019; Becchetti et al., 2015).[10]

2.3. CSR and CEO risk-taking incentives

Since CSR generates social capital and/or reduces a firm's elasticity of demand, thus reducing risk, how should firms respond? Several studies argue that option granting should be affected by a firm's risk environment (e.g. Edmans and Gabaix, 2011). The literature also finds that firms are active in structuring option-based compensation contracts to encourage risk-taking (e.g., Core and Guay, 2002; Coles et al., 2006; Gormley et al., 2013; Dittmann et al., 2017). As a firm's risk environment changes due to changes in its CSR status, we expect that CEO compensation structure will be adjusted to reflect that change. Specifically, we expect risk-taking incentives in compensation contracts to be higher (lower) when a firm faces lower (higher) business risks due to its higher (lower) CSR standing. As discussed previously, CSR status should affect what Gormley et al. (2013) refer to as "left-tail risk". Marginal projects become more attractive to shareholders when CSR improves and left-tail risk declines. As a result, shareholders should want to provide risk-averse CEOs with greater incentives to pursue risky projects. Also, from the shareholder's perspective, options are less costly to grant when CSR status is high and risk is low, so greater option-based compensation (and higher Vega) is feasible. From the

[8] The link between other measures of compensation incentives and firm risk is less clear. Guay (1999) notes that higher Delta - the sensitivity of CEO wealth to changes in stock prices - exposes managers to more personal wealth risk. While CEO compensation contracts with higher Delta can encourage executives to work harder to increase shareholder wealth, it can also discourage risk-averse executives from undertaking risky projects. Most empirical studies find no significant relation between CEO compensation Delta and firm risk (Coles et al., 2006; Low, 2009) and some show a negative relation. For example, Chava and Purnanandam (2010) show that Delta increases the likelihood that firms adopt risk reducing corporate policies.

[9] Cheung (2016) and Chang et al., (2019) examine the impact of CSR on corporate cash holdings. Mishra and Modi (2013) examine the impact of CSR on leverage.

[10] The studies noted above examine the relationship between measures of CSR and stock return volatility. A negative CSR-risk relation is also found when considering other indicators of risk. Attig et al. (2013), Jiraporn et al. (2014), Jung et al. (2018), Goss and Roberts (2011), and Oikonomou et al. (2014) study the impact of CSR on credit ratings or the cost of debt capital. Harjoto and Jo (2015), and El Ghoul et al. (2011) examine the impact of CSR on the cost of equity capital.

CEO's perspective, options are also more attractive when CSR status is high. Since left-tail risk decreases in that setting, the CEO should be more willing to accept a higher financial exposure to the firm through option compensation. Summing up, our *risk capacity* hypothesis can be formally stated as follows:

H1. (risk capacity): All else being equal, CSR standing has a positive impact on subsequent CEO risk-taking incentives (Vega).

3. Data and measurement

3.1. Sample selection

We gather our data from various sources. We collect CSR data using the most comprehensive database in the literature, MSCI ESG Stats (formerly known as the Kinder, Lyndenberg, and Domini (KLD) database). MSCI ESG Stats has been broadly used in scholarly research (e.g., Deng et al., 2013; Cheung, 2016; Chava, 2014; Giuli and Kostovetsky, 2014; Flammer and Luo, 2017; Servaes and Tamayo, 2013; Lins et al., 2017). We collect data for CEO incentives, accounting information, stock information and institutional ownership from Execucomp, Compustat, CRSP and 13F schedules, respectively. The data on delta, Vega, and board co-option is mostly downloaded from Dr. Lalitha Naveen's website (See Coles et al. (2006, 2014) for a detailed description of variable measurement).[11] We obtain data related to board of director attributes from ISS (formerly Riskmetrics) and BOARDEX databases, whereas analyst following data are collected from IBES. Merging different databases yields 24,496 firm-year observations for 2610 firms for the period 1992–2016.

3.2. Variable measurement

3.2.1. Vega

Following Guay (1999) and Core and Guay (2002), we use the Black and Scholes (1973) option valuation model to calculate Vega. This is consistent with many recent papers such as Anantharaman and Lee (2014), Coles et al. (2006), Low (2009), Hayes et al. (2012), and Kim and Lu (2011), and the common practice in evaluating executive incentives. Vega is defined as the change in the dollar value of the CEO's wealth for a 0.01 change in the annualized standard deviation of stock returns. Here, Vega is a proxy for CEO wealth-risk sensitivity, and thus captures the executive's risk-taking incentive (see Hagendorff and Vallascas, 2011; Croci and Petmezas, 2015).

3.2.2. Corporate social responsibility

Following previous research (e.g., Flammer and Luo, 2017), we focus on five dimensions of CSR: community activities, diversity, employee relations, environmental policies, and product development. MSCI ESG Stats is an annual data set (generated by MSCI ESG Research, a unit of MSCI) of positive and negative social performance indicators applied to publicly traded companies. In each category, MSCI ESG Research considers several possible strength and concern subcategories. See Appendix A for a detailed list of each category and subcategory. To assess social performance, MSCI ESG Research considers macro data from academic, government and NGO datasets, company disclosures, and over 1600 media outlets. Companies are also invited to participate in a data verification process. Strength indicators consider management's social capabilities, as captured by explicit strategy and governance statements, corporate initiatives, and corporate performance. Concern indicators are based on MSCI ESG Research's proprietary database on firm controversies. A firm is given a score of 1 in a strength or concern subcategory if it is judged by MSCI ESG Research to meet its proprietary criteria for that subcategory.

To formally examine the relation between CSR and Vega we begin by following the literature on CSR to construct an aggregate CSR score measure. We sum the total number of CSR strengths and subtract the total number of CSR concerns across these five categories and subcategories.[12] To mitigate concerns regarding reverse causality, we use lagged CSR scores in all models.

To test hypotheses *H1*, we begin by estimating the following model:

$$\begin{aligned}&\mathrm{VEGA}_{t+1}\\&= \beta_0 + \beta_1 \mathrm{CSR}_t + \beta_2 \mathrm{DELTA}_t + \beta_3 \mathrm{DUALITY}_t + \beta_4 \mathrm{TENURE}_t + \beta_5 \mathrm{AGE}_t + \beta_6 \mathrm{FEMALE}_t + \beta_7 \mathrm{OWNERSHIP}_t + \beta_8\\&\quad \mathrm{CASHCOMPENSATION}_t + \beta_9 \mathrm{EINDEX}_t + \beta_{10} \mathrm{INSTHOLD}_t + \beta_{11} \mathrm{ROA}_t + \beta_{12} \mathrm{LEVERAGE}_t + \beta_{13} \mathrm{CAPEX}_t + \beta_{14} \mathrm{Q}_t + \beta_{15}\\&\quad \mathrm{SIZE}_t + \beta_{16} \mathrm{ETHINDEX}_t + \beta_{17} \mathrm{FININDEX}_t + \beta_{18} \mathrm{NUMBOARDS} + \beta_{19} \mathrm{PCT\_FEMALE} + \beta_{20} \mathrm{BOARDSIZE} + \beta_{21}\\&\quad \mathrm{INDEPENDENCE}_t + \beta_{21} \mathrm{CO-OPTED}_t + \text{Firm or Industry Fixed Effects} + \text{Year Dummies} + \varepsilon_t \end{aligned} \quad (1)$$

where CSR_t is the aggregate CSR score in period t and all the control variables are defined below and in Appendix B.

[11] We thank Dr. Jeff Coles and his research assistant Jie Yang for updating the data of Delta and Vega for us.

[12] Given that the total number of strength and concern subcategories for most CSR categories vary greatly each year, we construct the scaled CSR measure, following Deng et al., (2013) and Lins et al., (2017), by dividing the strength and concern scores for each dimension by the respective total number of strength and concern areas to obtain *scaled* strength and concern scores for that dimension and then taking the difference between the scaled strength and concern scores. We discuss robustness tests using alternative CSR measures in Section 4.2.5.

3.2.3. Control variables

We include a variety of control variables that are shown in the literature to have an influence on Vega: 1) DELTA, defined as the dollar change in the value of CEO's annual equity-based compensation for a 1% change in the stock price,[13] 2: DUALITY, a dummy variable equal to one if the CEO is chair of the board, and zero otherwise (Boyd, 1995); 3) TENURE, defined as the length of time that the CEO has been at his or her position (Coles et al., 2006; Hayes et al., 2012); 4) AGE, defined as CEO's age in years (Kim and Lu, 2011); 5) FEMALE, an indicator variable taking the value of one if the CEO is female, and zero otherwise; 6) OWNERSHIP, defined as the percentage of outstanding common shares held by a CEO, deflated by total common shares outstanding (Kim and Lu, 2011); 7) CASH COMPENSATION, defined as salary plus bonus, as Guay (1999) and Coles et al. (2006) argue that CEOs with higher total cash compensation are better diversified given that they have more money to invest outside the firm and thus are less risk averse; 8) EINDEX, an entrenchment index, which considers various corporate charter elements that insulate the CEO from discipline (see Bebchuk et al., 2009)[14]; 9) INSTHOLD, defined as the percentage of institutional share ownership (Buchanan et al., 2018); 10) ROA, which is the operating income deflated by total assets (Coles et al., 2006; Low, 2009); 11) LEVERAGE, defined as total liabilities over total assets (Coles et al., 2006; Hayes et al., 2012); 12) CAPEX, which is defined as capital expenditure expenses over total assets (Coles et al., 2006; Low, 2009); 13) Q, which is Tobin's Q capturing growth opportunity and firm performance and is computed as the sum of book value of total assets plus market value of common stock less book value of equity over book value of assets (Kim and Lu, 2011); and 14) SIZE, defined as the log of total assets in millions of dollars at the fiscal year end (Coles et al., 2006; Anantharaman and Lee, 2014).

Following Ikram et al. (2019), we also control for board attribute variables that are likely to affect CEO compensation 1) ETHINDEX, which is the Herfindahl index of ethnicity (categorized as White/Caucasian, African American, Asian, Hispanic and other); 2) FININDEX, the number of finance experts divided by the number of directors; 3) NUMBOARDS, the average number of outside board seats; 4) PCT_FEMALE, percentage of female directors on the board; 5) BOARDSIZE, the number of directors on the board; 6) INDEPENDENCE, the number of independent outside directors divided by board size; 7) CO-OPTED, the percentage of directors appointed after the CEO assuming the role (Coles et al., 2014). Since these variables are not available for all firm years, we report models with them included separately.

4. Empirical evidence

4.1. Descriptive statistics and correlations

Table 1 reports means and standard deviations for the primary variables of interest in our sample of firm-year observations. Our variables encompass five areas: 1) CSR variables; 2) CEO characteristics; 3) control variables; 4) board attributes; and 5) other governance variables. Whereas our main sample consists of 24,496 observations, the sample with board attribute variables reduces to 19,149 observations. The mean value of *CSR* is 0.43 and the standard deviation is 2.47, suggesting that significant variation exists among firms in their CSR standings. Our *CSR* scores are comparable to those in other studies (e.g., El Ghoul et al., 2011). For instance, the mean score is 0.19 with a standard deviation of 2.22 in El Ghoul et al. (2011).

The average value for *VEGA* is 123, which is similar to statistics reported in Coles et al. (2006). The average value for *DELTA* is 1287, which is also comparable to values reported in Coles et al. (2006). In addition, our descriptive statistics reveal that the average Tobin's Q (*Q*) is 1.97 for our sample firms; an average CEO has been at the position for 7 years; the average percentage of institutional share ownership is 74.6%; the average financial leverage is 57.4%. In sum, all variables appear to be in sensible ranges and are comparable to those in prior studies (e.g., Coles et al., 2006; Hayes et al., 2012).

Table 2 reports Pearson correlation coefficients. Firms with higher *CSR* scores are associated with higher *VEGA,* which is consistent with our *risk capacity hypothesis*. Further, firms with longer-tenured and higher-cash compensation CEOs, higher return on assets, higher Tobin's Q, and larger size are more likely to offer compensation with greater risk-taking incentives (i.e., higher Vega). Conversely, firms with more spending on capital expenditure are less likely to incentivize their CEOs to take on risks.

4.2. The relation between CSR and CEO Vega

4.2.1. Overall CSR measures and Vega

Table 3 presents models that test our primary hypothesis. To mitigate concerns of endogeneity and omitted variables, we employ three models: industry-fixed effect model, firm-fixed effect model, and lagged dependent variable model.[15] Year-fixed effects are controlled for in all the models. The R-squares for all models range from 42% to 77%, suggesting that these models are significant in describing variation for CEO's risk-taking incentives, Vega. Columns (1)–(3) report results without controlling for board characteristics, whereas columns (4)–(6) show results after controlling for board characteristics including the variables *ETHINDEX*, *FININDEX*, *NUMBOARDS*, *PCT_FEMALE*, *BOARDSIZE*, *INDEPENDENCE* and *CO-OPTED*. Column (1) presents results from the industry-fixed effect

[13] Coles et al. (2006) argue that DELTA should be included in models explaining Vega because a higher DELTA may create incentives to reduce risk.

[14] In unreported sensitivity analyses, we consider the G-index as in Gompers et al. (2003) and our findings are unaffected.

[15] Motivations to include industry-fixed effect model, firm-fixed effect model and lagged dependent variables are discussed in Section 4.2.3 Granger Causality Analysis.

Table 1
Descriptive statistics.

	N	Mean	Median	Standard deviation	Minimum	Maximum
CSR Variables						
CSR	24,496	0.427	0	2.473	-9	17
STRENGTH	24,496	1.717	1	2.414	0	21
CONCERN	24,496	1.290	1	1.569	0	13
CEO Variables						
DELTA	24,496	1287	168	13,302	0	709,830
VEGA	24,496	123	34	297	0	11,340
DUALITY	24,496	0.48	0	0.500	0	1
TENURE (years)	24,496	7.124	5	7.214	0	55
AGE	24,496	56.113	56	7.130	28	91
OWNERSHIP (%)	24,496	2.038	0.373	5.137	0	87.6
FEMALE	24,496	0.025	0	0.155	0	1
CASH COMPENSATION	24,496	1236	910	1575	0	77,930
CONTROL Variables						
Q	24,496	1.970	1.534	1.401	0.353	30.32
INSTHOLD (%)	24,496	74.57	77.60	21.869	0	100
ROA	24,496	0.045	0.047	0.113	−4.753	2.604
LEVERAGE	24,496	0.574	0.568	0.257	0	7.745
CAPEX	24,496	0.046	0.031	0.054	−0.033	0.744
SIZE	24,496	7.988	7.823	1.691	2.330	14.80
BOARD Variables						
SUSTAINABILITY	20,903	0.115	0	0.319	0	1
ETHINDEX	19,149	9.878	9.965	1.978	4.626	12.223
FININDEX	19,149	9.550	9.567	2.034	6.079	11.844
NUMBOARDS	19,149	10.258	10.056	1.930	7.476	23.934
PCT_FEMALE (%)	19,149	10.263	10.039	1.975	7.845	21.009
BOARDSIZE	19,149	9.638	9	2.543	3	34
INDEPENDENCE (%)	19,149	75.29	77.8	13.8	8.3	100
CO-OPTED (%)	14,723	46.5	42.8	31.2	0	100
OTHER GOVERNANCE Variable						
ANALYSTFOLLOWING	24,137	11.329	9	7.997	1	54

This table provides descriptive statistics for the variables used in our analysis over the sample period. The sample consists of 24,496 observations for 2610 firms over fiscal years 1992 to 2016. All variables are defined in the Appendix.

model. The significantly positive coefficient on *CSR* supports our *H1*. Columns (2) and (3) employ the firm-fixed effect model and the lagged dependent model, respectively. The coefficients on *CSR* in predicting *VEGA* remain positive and significant. The results in columns (4)–(6) remain robust after controlling for board characteristics. In our base model, we find that a one standard deviation change in CSR status results in 30.41 (=0.123*2.473*100) increase in CEO Vega,[16] which represents a 25% increase in mean value of Vega.[17]

4.2.2. The effect of CSR on subsequent CEO option grants

Although the analysis in Table 3 establishes a positive link between CSR and subsequent CEO risk-taking incentives, the underlying mechanism through which firms adjust incentives in response to CSR outcomes has not been identified. One possible channel for the board to adjust CEO risk-taking incentives is through option grants. Therefore, we test whether CSR status is related to subsequent CEO option grants. We assume two proxies for option grants: one is the number of options granted to CEO in year t + 1 ($OPTION_{t+1}$) and the other is the value, more specifically the grant date fair value, of options granted to CEO in t + 1 ($OPTIONVALUE_{t+1}$). Columns (1)–(3) of Table 4 summarize the results using $OPTION_{t+1}$ as the dependent variable and Columns (4)–(6) using $OPTIONVALUE_{t+1}$. The coefficients on *CSR* are positive and significant in all columns except column (6), indicating that CSR status is positively associated with both the number and the value of options granted to the CEO in the subsequent period. These findings suggest that granting more options is an important mechanism that the board engages to adjust CEO compensation incentives in response to CSR outcomes.

4.2.3. Granger causality analysis

In our analysis thus far, we have used different control variables and fixed effects models to address the issues of endogeneity and

[16] It should be noted that we scale our original *VEGA* score by 100 in our regression analyses to avoid reporting extremely large coefficients.

[17] We also test the impact of CSR on CEO's pay-performance sensitivity, Delta, defined as the change in dollar value of the CEO's wealth for a one-percentage point change in stock price. While high Delta aligns the interests of executives and shareholders, its relation to firm risk is ambiguous. Prior studies demonstrate that there is no significant relation between Delta and firm risk (Coles et al., 2006; Low, 2009). We find the relationship between CSR and Delta is insignificant.

Table 2
Pearson correlation.

	DELTA	VEGA	CSR	STRENGTH	CONCERN	TENURE	CASH COMPENSATION	INSTHOLD	ROA	LEVERAGE	CAPEX	Q	SIZE
DELTA	1												
VEGA	0.349***	1											
CSR	0.070***	0.218***	1										
STRENGTH	0.073***	0.329***	0.794***	1									
CONCERN	0.002	0.163***	−0.355***	0.287***	1								
TENURE	0.076***	0.066***	−0.043***	−0.091***	−0.072***	1							
CASH COMPENSATION	0.034***	0.253***	0.055***	0.170***	0.174***	0.040***	1						
INSTHOLD	−0.052***	−0.026***	−0.032***	−0.100***	−0.103***	−0.007	−0.050***	1					
ROA	0.058***	0.068***	0.068***	0.041***	−0.013***	0.038***	0.045***	0.034***	1				
LEVERAGE	−0.008	0.049***	0.068***	0.135***	0.103***	−0.089***	0.127***	−0.099***	−0.195***	1			
CAPEX	−0.005	−0.025***	−0.053***	−0.006	0.074***	−0.009	0.016***	−0.031***	0.047***	−0.105***	1		
Q	0.136***	0.081***	0.087***	0.031***	−0.087***	0.038***	−0.015**	0.014**	0.278***	−0.108***	0.094***	1	
SIZE	0.090***	0.337***	0.303***	0.515***	0.313***	−0.072***	0.340***	−0.086***	−0.018***	0.443***	−0.108***	−0.235***	1

This table reports the Pearson correlation coefficients among variables for 24,496 observations for 2610 firms for the period 1992–2016. See Appendix for variable definitions. The superscripts *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed test), respectively.

Table 3
The effects of CSR on VEGA.

	Industry-fixed effect model (1)	Firm-fixed effect model (2)	Lagged Dependent model (3)	Industry-fixed effect model (4)	Firm-fixed effect model (5)	Lagged Dependent model (6)
Intercept	−1.737***	−3.754***	0.137	−3.714***	−5.478***	0.098
	(0.00)	(0.00)	(0.64)	(0.00)	(0.00)	(0.83)
VEGA			0.834***			0.844***
			(0.00)			(0.00)
CSR	**0.123*** **	**0.118*** **	**0.013*** **	**0.132*** **	**0.129*** **	**0.012***
	(0.00)	**(0.00)**	**(0.01)**	**(0.00)**	**(0.00)**	**(0.07)**
DELTA	0.014***	0.014***	0.003***	0.015***	0.015***	0.004***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
DUALITY	0.360***	0.579***	0.082***	0.257***	0.368***	0.068*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.08)
TENURE	0.032***	0.026***	0.004**	0.039***	0.035***	0.009***
	(0.00)	(0.00)	(0.05)	(0.00)	(0.00)	(0.01)
AGE	−0.003	−0.007**	−0.004**	−0.002	−0.004	−0.004*
	(0.30)	(0.02)	(0.02)	(0.56)	(0.32)	(0.10)
FEMALE	0.047	0.055	0.094	0.021	−0.016	0.089
	(0.71)	(0.68)	(0.25)	(0.90)	(0.93)	(0.41)
OWNERSHIP	−0.031***	−0.029***	−0.005**	−0.023***	−0.023***	−0.002
	(0.00)	(0.00)	(0.05)	(0.00)	(0.00)	(0.73)
CASH COMPENSATION	0.066***	0.115***	0.037***	0.022	0.074***	0.002
	(0.00)	(0.00)	(0.00)	(0.44)	(0.00)	(0.99)
EINDEX	−0.104***	−0.122***	−0.040*	−0.175***	−0.195***	−0.037
	(0.00)	(0.00)	(0.06)	(0.00)	(0.00)	(0.18)
INSTHOLD	−0.255***	0.001	−0.119*	−0.054	0.024	−0.033
	(0.01)	(0.99)	(0.06)	(0.72)	(0.87)	(0.74)
ROA	0.007	−0.224	−0.015	0.418	0.280	−0.170
	(0.97)	(0.21)	(0.89)	(0.14)	(0.33)	(0.35)
LEVERAGE	−0.906***	−1.157***	−0.180***	−1.283***	−1.644***	−0.244***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
CAPEX	−0.701	−0.501	0.047	−0.420	−0.384	0.199
	(0.12)	(0.17)	(0.87)	(0.15)	(0.45)	(0.62)
Q	0.276 ***	0.293 ***	0.121 ***	0.268 ***	0.271 ***	0.144 ***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
SIZE	0.704***	0.619***	0.134***	0.789***	0.694***	0.138***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Board Characteristics				Controlled	Controlled	Controlled
Fixed Effects	Year&Industry	Year&Firm	Year&Industry	Year&Industry	Year&Firm	Year&Industry
Adjusted R^2	0.43	0.41	0.77	0.43	0.42	0.77
# Observations	24,496	24,496	24,496	14,723	14,723	14,723

This table presents the results for the effects of corporate social responsibility (CSR) on CEO incentive, i.e., VEGA. The dependent variable in each regression is the leading Vega (i.e., $VEGA_{t+1}$), where *VEGA* is measured as the dollar change in the value of CEO's annual equity-based compensation associated with a 0.01 change in the annualized standard deviation of the firm's returns (divided by 100). *CSR* is the net score of CSR rating (total strengths subtracting total concerns), based on five categories of KLD rating data, i.e., community, diversity, employee relations, environment, and product. Columns (1)–(3) represent models without controlling for board characteristics, whereas columns (4)–(6) represents models controlling for board characteristics (*ETHINDEX*, *FININDEX*, *NUMBOARDS*, *PCT_FEMALE*, *BOARDSIZE*, *INDEPENDENCE*, and *CO-OPTED*) in a reduced sample. All other variables are defined in the Appendix. Coefficient estimates (*p*-values) are provided in the top (bottom) row. The superscripts *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed test), respectively.

omitted variables. The results are robust to controlling for various observable firm and manager characteristics and unobservable time, industry, firm, and manager fixed effects. We also include a lagged dependent variable (i.e., lagged *VEGA*) as a right-hand side variable for a robustness check. Lagged Vega is important because it contains *all* the information that determines the level of Vega until the point of year t. Even after controlling for Vega at year t, CSR at year t still provides incremental explanatory power to explain Vega at year t + 1. Untabulated results indicate the similar effects of *changes* in CSR on *changes* in Vega.

As discussed previously, reverse causality is possible although we believe it would likely lead to a negative CSR-Vega relation in this case. Higher Vega induces more risk-taking and therefore less CSR investment (because, on average, CSR reduces risk). To empirically investigate which direction of causality dominates, we conduct Granger Causality tests (Granger, 1969) to examine the nature of relations between CSR and Vega as well as the direction of causality. Given the time series of the data on two variables X and Y, X is said to "Granger cause" Y if the lagged values of X are significant predictors of Y incremental to lagged values of Y. We use the following specifications to test the significance of the coefficients on the lagged values of CSR in Eq. (2) and the lagged values of Vega in Eq. (3):

$$Vega_t = \sum_{i=1}^{n} \alpha_i Vega_{t-i} + \sum_{i=1}^{n} \beta_i CSR_{t-i} + \varepsilon t \quad (2)$$

Table 4
The effects of CSR on subsequent CEO option grants.

	Dependent Variable: $OPTION_{t+1}$			Dependent Variable: $OPTIONVALUE_{t+1}$		
	Industry-fixed effect model (1)	Firm-fixed effect model (2)	Lagged Dependent model (3)	Industry-fixed effect model (4)	Firm-fixed effect model (5)	Lagged Dependent model (6)
Intercept	1.024***	1.380***	0.511***	0.771**	1.487***	0.257
	(0.00)	(0.00)	(0.00)	(0.02)	(0.00)	(0.34)
OPTION			0.704***			
			(0.00)			
OPTIONVALUE						0.647***
						(0.00)
CSR	**0.029*** **	**0.026*** **	**0.008** **	**0.014*** **	**0.023*** **	**0.003**
	(0.00)	**(0.00)**	**(0.02)**	**(0.01)**	**(0.00)**	**(0.51)**
DELTA	0.001***	0.001***	0.003***	0.001***	0.001***	0.001***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
DUALITY	0.110***	0.223***	0.028	0.137***	0.279***	0.049**
	(0.00)	(0.00)	(0.21)	(0.00)	(0.00)	(0.03)
TENURE	0.020***	0.015***	0.005**	0.025***	0.020***	0.007***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)
AGE	−0.004**	−0.007***	−0.003**	−0.007***	−0.007***	−0.004**
	(0.05)	(0.00)	(0.03)	(0.00)	(0.00)	(0.02)
FEMALE	−0.115	−0.080	−0.017	−0.134	−0.089	−0.029
	(0.19)	(0.37)	(0.80)	(0.12)	(0.32)	(0.67)
OWNERSHIP	0.006	0.002	0.003	0.009**	−0.002	0.007**
	(0.13)	(0.59)	(0.36)	(0.03)	(0.89)	(0.03)
CASH COMPENSATION	0.057***	0.099***	0.029**	0.104***	0.157***	0.068***
	(0.00)	(0.00)	(0.03)	(0.00)	(0.00)	(0.00)
EINDEX	−0.019	−0.031	0.001	0.028	0.018	0.027*
	(0.35)	(0.14)	(0.99)	(0.17)	(0.39)	(0.09)
INSTHOLD	−0.198***	−0.256***	−0.022	0.636***	0.307***	0.224***
	(0.01)	(0.00)	(0.72)	(0.00)	(0.00)	(0.00)
ROA	−1.207***	−1.371***	−0.491***	−0.122	−0.345***	0.052
	(0.00)	(0.00)	(0.00)	(0.37)	(0.01)	(0.62)
LEVERAGE	−0.327***	−0.369***	−0.146***	−0.639***	−0.669***	−0.234***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
CAPEX	−0.723***	0.131	0.103	0.423	0.782***	−0.132
	(0.01)	(0.61)	(0.66)	(0.17)	(0.00)	(0.59)
Q	0.131 ***	0.137 ***	0.034***	0.276***	0.301***	0.100***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
SIZE	0.370***	0.303***	0.110***	0.489***	0.414***	0.157***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Board Characteristics	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed Effects	Year & Industry	Year & Firm	Year & Industry	Year & Industry	Year & Firm	Year & Industry
Adjusted R^2	0.31	0.27	0.66	0.43	0.38	0.67
# Observations	14,723	14,723	14,723	14,723	14,723	14,723

This table presents the results exploring the effect of CSR on subsequent CEO option grants. We adopt two proxies for option grants. In model (1), (2), and (3), the dependent variable is the leading option ($OPTION_{t+1}$), where *OPTION* is the log transformation of the amount of options granted to CEO. In model (4), (5), and (6), the dependent variable is lead option value ($OPTIONVALUE_{t+1}$), where *OPTIONVALUE* is the log transformation of the value of options granted to CEO, determined by Black-Sholes model. All variables are defined in the Appendix. Coefficient estimates (*p*-values) are provided in the top (bottom) row. The superscripts *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed test), respectively.

$$CSR_t = \sum_{i=1}^{n} \alpha_i CSR_{t-i} + \sum_{i=1}^{n} \beta_i Vega_{t-i} + \varepsilon t \quad (3)$$

To determine the optimal lag lengths *n*, we refer to the Bayesian information criterion (BIC) (Schwarz, 1978; Risannen, 1978) and the Hannan-Quinn information criterion (QIC) (Hannan and Quinn, 1979) and conclude the appropriate lengths should be 4 years.[18]

Consistent with our hypothesis that a firm's CSR standing influences its executive contracting of risk incentives, the evidence in Table 5 suggests that the causality from CSR to Vega is much stronger than the reverse causality. Based on the computed Chi-squares and their marginal significance level, Model 1 confirms that CSR Granger causes or leads Vega and Model 2 suggests that Vega leads CSR only at a marginal level.

4.2.4. Instrumental variable approach

To further mitigate endogeneity concerns, we use instrumental variable (IV) analysis to provide reasonable exogenous variation to

[18] For robustness, we also test 1, 2, and 3-year lags and obtain similar results.

identify the impact of CSR on Vega. Our first IV analysis (model 1) follows the recent literature (Deng et al., 2013; Cheung, 2016; Albuquerque et al., 2019) to use an instrument called *BLUESTATE* for CSR (see also Hong and Kostovetsky, 2012, and Di Giuli and Kostovetsky, 2014). This instrument takes the value of one if a firm's headquarters is located in a blue (Democratic) state for the Presidential election. The literature shows that this instrument is largely exogenous and has a significant impact on CSR: firms operating in a Democratic political environment (Blue States) are more likely to be socially responsible. The data pertaining to red/blue states are obtained from US Electoral College. We also believe it is less likely that the Democratic leaning of a state would influence CEO risk-taking incentives other than through its impact on a firm's investments to build CSR standing and reduce risks. Even if there are channels through which state political leaning influences risk incentives other than through its impact on CSR, we attempt to address this by including year and industry fixed effects in our models.[19]

Table 6 reports results for our Two-Stage Least Square instrumental variable models (2SLS). We estimate three models in which the endogenous regressor is our net *CSR* score. The first-stage model estimates reported in Column (1) indicate that the instrument (BLUESTATE) significantly explains our *CSR* regressor. Columns (2) through (4) report second stage models with different dependent variables. Along with the controls considered previously, we include the predicted CSR from the first stage model. In column (2) the dependent variable is lead Vega. Consistent with evidence in Table 3, predicted CSR has a significantly positive effect on Vega. In Column (3), the dependent variable is the lead number of options granted to CEO and in column (4), the dependent variable is the lead value of options granted to CEO. In both cases, the evidence is consistent with Table 4 and indicates that predicted CSR significantly positively affects option grants.

We statistically test the instruments for their relevance and validity. The first-stage F statistic surpasses the usual rule of thumb of 10; the over-identification test (Basmann's test) cannot reject the null hypothesis that the instruments are valid and orthogonal to the regression residuals, and the Hausman test rejects exogeneity of the endogenous variable CSR. These results suggest that these instruments are exogenous under the usual assessment of instrumental variables, and therefore 2SLS is more efficient than OLS in this setting.[20]

4.2.5. Alternative measures of CSR

To check the validity of our results, we consider alternative measures of CSR standing. As argued in Servaes and Tamayo (2013) and Lins et al. (2017), the product category of CSR is comprised of a number of elements that may be less relevant to corporate social performance and therefore outside the scope of CSR. We follow Servaes and Tamayo (2013) and define CSR as the sum of the net scores of community (*COMS*), diversity (*DIVS*), employee relations (*EMPS*), environment (*ENVS*) and human rights (*HUMS*). We replicate regressions in Tables 3 and 4, employing this alternative proxy for CSR and find that the revised CSR measure is significantly positively related to Vega and option grants in all models (industry fixed effects, firm-fixed effects and lagged dependent variables).[21]

4.2.6. CSR strengths and concerns

CSR strengths and concerns capture strong social performance and weak social performance respectively, but only limited studies have examined the different perspectives of strong versus weak performance. Most prior studies have taken CSR as a single construct. We continue developing the literature toward modeling CSR strengths and weaknesses separately (Hillman and Keim, 2001; Godfrey et al., 2009; Bansal et al., 2014). Kolbel et al. (2017) argue that CSR weakness scores capture corporate social irresponsibility (CSI), which they define based on Strike, Gao, and Bansal (2006, p. 852), as the “set of corporate actions that negatively affect an identifiable social stakeholder's legitimate claim”. They argue that CSI does more to destroy moral capital than CSR does to enhance it. Based on these arguments, CSR concerns should have a larger impact on a firm's risk environment than strengths. Consistent with this argument, Oikonomou et al. (2012) find that CSR strengths are weakly negatively related to firm risk whereas weaknesses (CSI) are strongly positively related to firm risk. An implication is that the association between Vega and concerns should be greater than strengths.

An alternative perspective on strengths and weaknesses emerges when considering the channels through which CSR can build social capital through civil engagement and cooperation norms. The civic engagement perspective of social capital pertains to activities through which firms contribute positively to the community and social life (e.g., Guiso et al., 2008; Scrivens and Smith, 2013).

[19] One potential channel is that BLUESTATE firms may be more optimistic about the economy under a democratic president, and therefore provide higher risk incentives. We use year fixed effects to control for this timing effect. It is also possible that when compared to BLUESTATE, REDSTATE is more pro-business and shareholder-friendly and therefore supports higher interest-aligning incentives such as Vega. If this is true, though not supported by the literature, we should observe a negative CSR-Vega relation, which biases against the positive relation we find in Table 6.

[20] Following a large literature on CSR, we also consider three alternative instruments for CSR. We calculate the average CSR score for each state-year pair and industry-year pair. Our first alternative instrument is the average CSR rating of all the firms, except the firm itself, in the state where the firm is located. The rationale is that regional CSR practices influence a firm's social performance (Goss and Roberts, 2011). Likewise, our second alternative instrument is based on industries because industry characteristics also determine CSR performance (Cheng et al., 2014). Meanwhile, it is unlikely that industrial CSR would directly affect a specific firm's compensation structure (after controlling for industry and year fixed effects). Based on similar arguments, Goss and Roberts (2011) and Cheng et al. (2014) use these IVs in their studies. Following Flammer (2018), we use enactment of constituency statutes as our third alternative IV for CSR. Such statutes allow firms to consider the interests of a range of stakeholders in meeting their fiduciary responsibilities. The exogenous passage of statutes arguably increases the likelihood that firms headquartered in the state will pursue activities that have positive effects on CSR standing. Our untabulated results indicate that our primary results persist after instrumenting CSR with these three IVs.

[21] The results, untabulated to conserve space in the paper, are available upon request.

Table 5
Granger causality test.

Dependant variable	$Vega_t$	CSR_t
CSR_{t-1}	0.091***	0.715***
	(0.00)	(0.00)
CSR_{t-2}	0.037***	0.033***
	(0.00)	(0.00)
CSR_{t-3}	0.001	0.028***
	(0.48)	(0.00)
CSR_{t-4}	0.001	0.011
	(0.35)	(0.12)
$Vega_{t-1}$	0.695***	0.028*
	(0.00)	(0.06)
$Vega_{t-2}$	0.023***	−0.015
	(0.01)	(0.11)
$Vega_{t-3}$	0.025***	−0.008
	(0.00)	(0.37)
$Vega_{t-4}$	0.001	0.010
	(0.39)	(0.19)
# Observations	21,086	21,086
	H0: CSR Do Not Cause Vega	H0: Vega Do Not Cause CSR
Chi-square	19.57***	6.17
(P-value)	(0.00)	(0.12)

This table presents the results of Granger causality test applied to the VAR residuals corresponding to *CSR* rating and *VEGA*. The optimal lag length is set to four based on the BIC and the QIC. Lagged values of *CSR* ratings and lagged values of *VEGA* are included. All variables are defined in the Appendix. Coefficient estimates (p-values) are provided in the top (bottom) row. The superscripts *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed test), respectively.

The trust and cooperative norms perspective of social capital include factors that contour the way that firms act as members of society. In this regard, social capital facilitates cooperation, shared value and reciprocity, thus resulting in positive outcomes (Guiso et al., 2004, 2008). Therefore, both the civic engagement and cooperation norms perspectives imply that CSR strengths rather than concerns engender trust and social capital. An implication in our setting is that strengths should have a larger impact on a firm's risk environment than concerns, in which case the Vega-strength relation would be stronger than the Vega-concern relation.

Finally, we note that CSR measurement issues potentially influence the significance of strengths and concerns. Gormley et al. (2013) suggest that adjustments to changes in the risk environment can be slow. While our core evidence uses one-year lag, results are similar with longer lags, consistent with adjustments being slow. MSCI ESG Research's assessment of most strength areas is based on publicly stated policies and initiatives. In contrast, the assessment of concerns is mostly based on third party assessments (e.g., media criticism by NGOs). From the firm's perspective, their strength rating should be much more predictable than their concern rating. Since expectations of CSR changes can impact the speed of adjustment in Vega, we expect that the CSR-Vega relation should be stronger for strength measures of CSR than concerns.

Empirically, we explore the relation between CEO incentives and CSR strengths and concerns using the following model:

$$VEGA_{t+1} = f\ (STRENGTH_t, CONCERN_t, Control\ Variables_t) + \varepsilon_t \quad (4)$$

where $STRENGTH_t$ is the sum of total CSR strengths and $CONCERN_t$ is the sum of CSR concerns for the firm in period *t*. Table 7 includes industry-fixed effect models (column 1), firm-fixed effect model (column 2), and lagged dependent models (column 3) to test for the separate effects of CSR strengths and concerns on Vega. In columns (4) and (5), we report second-stage instrumental variables models where the first stage for column (4) has STRENGTHS as the dependent variable and the first stage for column (5) has CONCERN as the dependent variable.[22] For columns (4) and (5), the STRENGTH and CONCERN variables are replaced with predicted values.

All models show a strong and significant relation between strengths and Vega. The relation between concerns and Vega are weaker and only occasionally statistically significant. The findings, therefore, are more consistent with civic engagement and co-operation norms perspective which suggests that strengths do more to build social capital than concerns do to destroy it. The findings are also consistent with measurement issues. Since strengths are more predictable, they should be more swiftly incorporated in board and CEO decisions regarding future risk-taking incentives. Interestingly, the instrumental variables evidence shows that *predicted* concerns also strongly impact future Vega, consistent with expectations playing an important role in the relation between CSR standing and firm decisions regarding CEO incentives.

We also consider models where the five separate categories of social performance are measured independently. Bouslah et al. (2013) find that the different CSR dimensions have different impacts on firm risk. In unreported results, we find that all categories of social performance have a significantly positive relation with future Vega except the product category (which is insignificant).[23]

[22] The first stage models, untabulated to conserve space in the paper, are available on request.

[23] As noted earlier, Servaes and Tamayo (2013) and Lins et al. (2017) argue that the product category of CSR is comprised of a number of elements that may be less relevant to corporate social performance. It is not surprising, therefore, that standing in product has no impact on Vega.

Table 6
The effect of CSR on Vega and option grants - instrumental variable approach.

	CSR Score First Stage (1)	$VEGA_{t+1}$ Second Stage (2)	$OPTION_{t+1}$ Second Stage (3)	$OPTIONVALUE_{t+1}$ Second Stage (4)
Intercept	−4.546***	−4.567***	0.772**	0.618***
	(0.00)	(0.00)	(0.03)	(0.00)
BLUESTATE (INSTRUMENT)	0.566***			
	(0.00)			
CSR		**0.321*** **	**0.138*** **	**0.100*** **
		(0.00)	**(0.00)**	**(0.00)**
DELTA	0.002	0.015***	0.001***	0.001***
	(0.41)	(0.00)	(0.00)	(0.00)
DUALITY	0.056	0.277***	0.118***	0.142***
	(0.40)	(0.00)	(0.00)	(0.00)
TENURE	0.018***	0.041***	0.020***	0.025***
	(0.00)	(0.00)	(0.00)	(0.00)
AGE	−0.022***	−0.005	−0.010***	−0.007***
	(0.00)	(0.24)	(0.00)	(0.00)
FEMALE	0.038	0.022	−0.123	−0.143
	(0.85)	(0.90)	(0.18)	(0.11)
OWNERSHIP	−0.005	−0.025***	0.006	0.009**
	(0.61)	(0.00)	(0.18)	(0.04)
CASH COMPENSATION	−0.196***	−0.001	0.050***	0.101***
	(0.00)	(0.98)	(0.00)	(0.00)
EINDEX	0.050	−0.159***	−0.013	0.032
	(0.27)	(0.00)	(0.52)	(0.13)
INSTHOLD	−0.769***	−0.108	−0.228***	0.621***
	(0.00)	(0.49)	(0.00)	(0.00)
ROA	0.770***	0.556*	−1.151***	−0.084
	(0.00)	(0.06)	(0.00)	(0.54)
LEVERAGE	−0.942***	−1.381***	−0.333***	−0.636***
	(0.00)	(0.00)	(0.00)	(0.00)
CAPEX	3.253***	0.125	−0.541*	0.546*
	(0.00)	(0.85)	(0.10)	(0.09)
Q	0.208***	0.284***	0.131***	0.275***
	(0.00)	(0.00)	(0.00)	(0.00)
SIZE	0.356***	0.840***	0.378***	0.493***
	(0.00)	(0.00)	(0.00)	(0.00)
Board Characteristics	Controlled	Controlled	Controlled	Controlled
Fixed Effect	Year& Industry	Year& Industry	Year& Industry	Year & Industry
Adjusted R^2	0.24	0.18	0.29	0.42
# Observations	14,723	14,723	14,723	14,723

This table presents the results for the effects of CSR on CEO incentive using instrumental variable for CSR. The endogenous regressor for is *CSR* overall score. In first stage (model (1)), we employ *BLUESTATE* as the instrument variable. *BLUESTATE* is a dummy variable, which equals one if a firm's headquarters is located in a blue (democratic) state and zero if otherwise. The dependent variable in the first stage is CSR. In second stage models (2)–(4), we use the predicted *CSR* values from the first stage as the independent variable. The dependent variable in reported second stage models are $VEGA_{t+1}$ (models 1 and 2), defined as the dollar change in the value of CEO's annual equity-based compensation associated with a 0.01 change in the annualized standard deviation of the firm's returns (divided by 100), $OPTION_{t+1}$ (model 3), defined as the log transformation of the amount of options granted to CEO, and $OPTIONVALUEt_{+1}$, defined as the log transformation of the value of options granted to CEO, determined by Black-Sholes model. Coefficient estimates (*p*-values) are provided in the top (bottom) row. The superscripts *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed test), respectively.

4.2.7. Other robustness tests

Our analysis thus far examines the impact of CSR standing on the conditional mean Vega. It is possible, however, that high risk is incompatible with CSR. In this case, the CSR would not play a role in explaining, for example, the 90th percentile of Vega. To explore this possibility, we replicate Table 3 using quantile regressions. In unreported results, we re-estimate each model in Table 3 predicting the 25th, 50th and 75th percentiles of Vega. In general, we find that the impact of CSR is more positive on the 75th percentile of Vega than the 25th percentile. In particular, we find that many firms with very low or zero Vega do not respond to CSR standings by granting any options to their executives. In contrast, firms with high Vega make greater adjustments according to CSR status; Vega appears to be an important incentive tool in such firms.

As discussed earlier, incentives in CEO option are different than those provided through CSR incentives which usually come in the form of cash or stock bonuses. While conceptually distinct, we recognize the possibility of a spurious relation since we find that the correlation between Vega and the presence of CSR incentives is positive (approximately 7%). In untabulated analysis, we replicate Tables 3 and 4 for different subsamples based on the presence of CSR incentives. We find that the impact of CSR on Vega remains significantly positive in both cases with coefficient magnitudes similar to what we report in our core models.

Table 7
The effects of CSR strength and concern on VEGA.

	Industry-fixed effect model (1)	Firm-fixed effect model (2)	Lagged Dependent model (3)	IV (4)	IV (5)
Intercept	−3.235***	−4.841***	0.134	−2.971***	−0.257
	(0.00)	(0.00)	(0.77)	(0.00)	(0.71)
VEGA			0.843***		
			(0.00)		
STRENGTH	**0.185*** **	**0.200*** **	**0.016** **	**0.506*** **	
	(0.00)	**(0.00)**	**(0.04)**	**(0.00)**	
CONCERN	**−0.015**	**0.019**	**−0.003**		**−1.277*** **
	(0.41)	**(0.24)**	**(0.82)**		**(0.00)**
DELTA	0.015***	0.015***	0.004***	0.014***	0.014***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
DUALITY	0.238***	0.323***	0.066*	0.403***	0.402***
	(0.00)	(0.00)	(0.08)	(0.00)	(0.00)
TENURE	0.041***	0.039***	0.009***	0.031***	0.031***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
AGE	−0.004	−0.006	−0.004*	−0.005	−0.005
	(0.38)	(0.14)	(0.10)	(0.14)	(0.23)
FEMALE	−0.035	−0.090	0.084	0.157	0.157
	(0.84)	(0.60)	(0.44)	(0.27)	(0.37)
OWNERSHIP	−0.025***	−0.026***	−0.002	−0.033***	−0.033***
	(0.00)	(0.00)	(0.70)	(0.00)	(0.00)
CASH COMPENSATION	0.025	0.071***	0.001	0.051**	0.051*
	(0.39)	(0.01)	(0.98)	(0.02)	(0.07)
EINDEX	−0.154***	−0.164***	−0.035	−0.085**	−0.085*
	(0.00)	(0.00)	(0.21)	(0.02)	(0.06)
INSTHOLD	0.091	0.184	−0.021	−0.333***	−0.333***
	(0.55)	(0.20)	(0.83)	(0.00)	(0.01)
ROA	0.403	0.208	−0.171	0.105	0.105
	(0.16)	(0.47)	(0.35)	(0.59)	(0.66)
LEVERAGE	−1.255***	−1.464***	−0.243***	−0.946***	−0.946***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
CAPEX	−0.589	−1.033**	0.185	−0.319	−0.319
	(0.35)	(0.04)	(0.64)	(0.51)	(0.59)
Q	0.257***	0.262***	0.144***	0.288***	0.288***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
SIZE	0.680***	0.574***	0.130***	0.771***	0.771***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Board Characteristics	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed Effects	Year&Industry	Year&Firm	Year&Industry	Year&Industry	Year&Industry
Adjusted R^2	0.44	0.43	0.77	0.39	0.30
# Observations	14,723	14,723	14,723	14,723	14,723

This table presents the results for the effects of CSR STRENGTH and CONCERN on CEO incentive, i.e., VEGA. The dependent variable in each regression is the leading Vega (i.e., $VEGA_{t+1}$), where *VEGA* is measured as the dollar change in the value of CEO's annual equity-based compensation associated with a 0.01 change in the annualized standard deviation of the firm's returns (divided by 100). *STRENGTH* is the sum of all strength scores, and *CONCERN* is the sum of all concern scores, based on five categories of KLD rating data, i.e., community, diversity, employee relations, environment, and product. Columns (1)–(3) represent represents models controlling for board characteristics (*ETHINDEX*, *FININDEX*, *NUMBOARDS*, *PCT_FEMALE*, *BOARDSIZE*, *INDEPENDENCE*, and *CO-OPTED*) in a reduced sample. Columns (4) and (5) report estimates from the second stage of Instrument Variables regressions. The first stage for column (4) has STRENGTH as the dependent variable and the first stage for column (5) has CONCERN as the dependent variable. The instrument is BLUESTATE, a dummy variable equal to one if the firms' headquarters is located in a blue (democratic) state and zero if otherwise. The second-stage models reported use predicted values of STRENGTHS and CONCERNS from the first stage models. All other variables are defined in the Appendix. Coefficient estimates (*p*-values) are provided in the top (bottom) row. The superscripts *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed test), respectively.

4.2.8. Additional implications of the risk capacity hypothesis

While the evidence presented thus far is consistent with our *risk capacity* hypothesis, we further test additional implications of this hypothesis. If risk capacity is driving our findings, the CSR-Vega relation should be more significant for firms where the potential impact of CSR on risk is expected to be largest. Albuquerque et al. (2019) find that the risk-reducing effects of CSR are larger for firms having greater product differentiation. We, therefore, expect that the CSR-Vega relation should be stronger for firms with greater product differentiation. Formally, we estimate the model:

$$\mathrm{VEGA}_{t+1} = \beta_0 + \beta_1 \mathrm{CSR}_t + \beta_2 \mathrm{CSR}_t * \mathrm{DIFF}_t + \beta_3 \mathrm{CONTROLS}_t \quad (5)$$

Where DIFF_t is a dummy variable equal to one if the firm exhibits high product differentiation and 0, otherwise ($\mathrm{CONTROLS}_t$ is a vector of control variables considered previously). In this specification, we expect β_2 to be significantly positive.

Table 8
The effects of industry characteristics and other groupings.

	High-tech vs. Non-High-tech (1)	Consumer goods vs. Capital goods (2)	Financially distressed vs. healthy (3)	High vs. Low Credit Rating (4)	High vs. Low Tobin's Q (5)
Intercept	−5.797***	−5.193***	−5.425***	−5.925***	−5.218***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
CSR	0.081***	0.133**	0.178***	0.106***	0.020
	(0.00)	(0.02)	(0.00)	(0.00)	(0.19)
HIGH-TECH	0.376***				
	(0.00)				
*CSR*HIGH-TECH*	0.148***				
	(0.06)				
CONSUMER		0.128*			
		(0.09)			
*CSR*CONSUMER*		0.015			
		(0.55)			
DISTRESSED			−0.333***		
			(0.00)		
*CSR*DISTRESSED*			−0.089***		
			(0.00)		
CREDITRATING				−0.006	
				(0.92)	
*CSR*CREDITRATING*				0.034*	
				(0.10)	
HIGHQ					0.772***
					(0.00)
*CSR*HIGHQ*					0.181***
					(0.00)
Control Variables	Included	Included	Included	Included	Included
Board Characteristics	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed Effect	Year&Firm	Year&Firm	Year&Firm	Year&Firm	Year&Firm
Adjusted R^2	0.42	0.45	0.42	0.51	0.43
# Observations	14,723	8008	14,723	14,723	14,723

This table shows the OLS results when partitioning the sample according to different industry/firm characteristics. Industry classifications are based on Lev et al. (2010). Column (1) reports results for high-tech versus non-high-tech firms, where high-tech firms belong to Drugs (SIC code 2833–2836), Computers (3570–3577), Electronics (3620–3674), Programming (7370–7374), and R&D Services (8731–8734). Column (2) reports results for consumer goods versus capital goods industry firms, where capital goods firms are with SIC codes 3400–3419, 3440–3599 excluding 3523, 3670–3699, 3800–3849, 5080–5089, 5100–5129, and 7300–7399. Consumer goods industry firms are with SIC codes 0000–0999, 2000–2399, 2500–2599, 2700–2799, 2830–2869, 3000–3219, 3420–3429, 3523, 3600–3669, 3700–3719, 3751, 3850–3879, 3880–3999, 4813, 4830–4899, 5000–5079, 5090–5099, 5130–5159, 5220–5999, 7000–7299, and 7400–999). Column (3) reports results for financially distressed versus financially healthy firms, where financially distressed firms have *Z*-Score below 1.81 (Eisdorfer, 2008) and financially healthy firms have Z-Score equal to or above 1.81. Column (4) presents results for firms based on credit rating (CREDITRATING equals 1 if the firm rating is above the median value of 11, where rating values range from 1 for S&P D rating to 24 for S&P AAA rating). Column (5) reports results for high Tobin's Q vs. low Tobin's Q, where high Q firms are those with Tobin's Q equal to or above the median (1.5), and low Q firms are those below 1.5. The dependent variables in all models are $VEGA_{t+1}$. All variables are defined in the Appendix. Coefficient estimates (*p*-values) are provided in the top (bottom) row. The superscripts *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed test), respectively.

Estimates of Eq. (5) using OLS are reported in the first two columns of Table 8.[24] In the first model $DIFF_t$ is set to 1 if the firm is in a high-tech industry,[25] and in the second model $DIFF_t$ is set to 1 if the firm is in a consumer industry.[26] The coefficient β_2 is positive in both cases, and significantly so when product differentiation is defined based on high-tech status.

Conceptually, there are different types of risks a manager can take. "Good" risks are those arising from activities motivated by the desire to enhance firm value; "bad" risks are associated with poor management practices (e.g., investing in declining industries) or risk shifting (taking risks to expropriate bondholder wealth). The *risk capacity* hypothesis argues that firms adjust risk-taking incentives to enhance value. Therefore, the CSR-Vega relationship should be stronger for firms more likely to take on "good" risks rather than "bad". Formally, we estimate the model:

$$VEGA_{t+1} = \beta_0 + \beta_1 CSR_t + \beta_2 CSR_t * GOODRISK_t + \beta_3 CONTROLS_t \quad (6)$$

[24] We also estimate Eq. (5) using 2SLS where we instrument CSR_t and CSR_t* $DIFF_t$ (separately) using the BLUESTATE variable as defined earlier. Results are qualitatively similar to what we report in Table 8

[25] Industries are identified using four-digit SIC codes. High-tech industries include Drugs (SIC code 2833–2836), Computers (3570–3577), Electronics (3620–3674), Programming (7370–7374), and R&D Services (8731–8734).

[26] Consumer goods firms have SIC codes 0000–0999, 2000–2399, 2500–2599, 2700–2799, 2830–2869, 3000–3219, 3420–3429, 3523, 3600–3669, 3700–3719, 3751, 3850–3879, 3880–3999, 4813, 4830–4899, 5000–5079, 5090–5099, 5130–5159, 5220–5999, 7000–7299, and 7400–9999. Lev et al. (2010) show that consumer goods firms have relatively higher product differentiation. Jones (1999) also show that CSR reputation is more important for consumer goods firms.

where $GOODRISK_t$ is a dummy variable equal to one if the firm is more likely than the typical firm to pursue good risk and 0, otherwise. In this specification, we expect β_2 to be significantly positive under the risk capacity hypothesis. OLS estimates of Eq. (6) are reported in columns (3) to (5) of Table 8.[27] In column (3) $GOODRISK_t$ equals one if the firm is not financially distressed (*Z*-Score above 1.81) versus financially healthy firms. We expect that financially distressed firms are more likely to take on bad risks (Eisdorfer, 2008). In column (4) $GOODRISK_t$ equals one if the firm has an above median credit rating. We expect that firms with lower credit ratings are more likely to take on bad risks. Finally, in column (5) $GOODRISK_t$ equals one if the firm has an above median Tobin's Q. Firms with high Tobin's Q are likely to have more value-enhancing growth opportunities than low-Q firms. We would expect high-Q firms to have more projects of good risks. In all three cases the coefficient is significantly positive, consistent with predictions of the risk capacity hypothesis.

5. Alternative explanations for the CSR-Vega relation

Although we find strong evidence to support risk capacity theory thus far, alternative explanations for our findings are possible. For instance, Bebchuk and Fried (2003) find that powerful CEOs set their own pay and prefer compensation schemes with more cash and fewer options. Powerful CEOs are also likely to invest little in CSR so they can expropriate more resources and consume more perquisites (e.g., El Ghoul et al., 2016). Taken together, the entrenchment hypothesis predicts a positive CSR-Vega relation only for firms with weak governance. The risk capacity hypothesis posits that firms and CEOs adjust risk-taking incentive to improve firm decision making and enhance value. Since well-governed firms are more likely to make value-enhancing decisions, a stronger CSR-Vega relation for well-governed firms would be consistent with the *risk capacity* hypothesis. Formally, we estimate the model:

$$VEGA_{t+1} = \beta_0 + \beta_1 CSR_t + \beta_2 CSR_t * GOODGOV_t + \beta_3 CONTROLS_t \quad (7)$$

where $GOODGOV_t$ is a dummy variable equal to one if the firm is more likely than the typical firm to have strong governance and 0, otherwise. In this specification, we expect β_2 to be significantly positive under the risk capacity hypothesis and significantly negative under the entrenchment hypothesis.

We consider both internal governance and external governance variables. To capture internal governance, we construct five different dummy variables that are set to one for firms with strong board control, and zero otherwise. The first (LETHINDEX) equals one if the *ETHINDEX* (ethnic diversity) measure is below median (lower numbers correspond to greater diversity). The second (HFININDEX) equals one if the *FININDEX* (board financial expertise) measure is above median. The third (*SUSTAINABILITY*) equals one if the firm's board has a sustainability/CSR committee. The fourth (*HNUMBOARDS*) equals one if the *NUMBOARDS* (the breadth of board experience) measure is above median. Finally, the fifth (*HFEMALE*) equals 1 if *PCT_FEMALE* (board gender diversity) is above median. To capture external governance variables, we use a dummy variable (*HANALYSTFOLLOWING)* equal to one if the number of analysts following a firm is above median. We posit that governance should be stronger for firms with greater analyst following.

Table 9 presents OLS estimates models of Eq. (7) using different proxies for GOODGOV as introduced above.[28] In all cases, coefficient β_2 is significantly positive, consistent with risk capacity. Further, it should be noted that the coefficients for CSR (β_1) remain positive and are generally significant across models. Taken collectively, our results provide strong support for the *risk capacity* hypothesis rather than the *entrenchment* hypothesis. Our results also highlight that board control is effective in setting CEO compensation even after controlling for many variables related to CEO power (e.g., CEO tenure, duality, and percentage of ownership).

6. Conclusion

In this paper, we examine whether and how firms adjust CEO risk-taking incentives in response to the risk environment associated with CSR standing. Our primary analysis considers the relation between measures of aggregate CSR status and Vega. We find that as CSR status improves (declines), firms respond by adjusting CEO compensation contracts to increase (decrease) risk-taking incentives. To better understand how firms adjust Vega, we consider option grants and find that such grants vary significantly and positively with CSR changes. Taken collectively, our findings suggest that firms actively adjust CEO incentives in response to CSR standing through option grants.

We test the role of corporate governance in the CSR-Vega relation and find that the positive association is more pronounced in firms with stronger board control and more analyst following. The results indicate that the positive association between CSR and Vega is driven by *risk capacity* but not CEO entrenchment.

Finally, we explore the effect of firm riskiness on CSR-Vega relation and find it stronger for the high-tech industries, the consumer goods industries, firms with sound financial condition, higher credit ratings and with higher Tobin's Q. In sum, the further analyses indicate that in settings where riskiness is expected to be more paramount, the CSR-Vega relationship is stronger, consistent with the *risk capacity* hypothesis.

Since the extensive empirical literature linking CSR to firm risk does not consider the moderating effects of CEO incentives, our

[27] We also estimate Eq. (6) using 2SLS where we instrument CSR_t and CSR_t* $GOODRISK_t$ (separately) using the BLUESTATE variable as defined earlier. Results are qualitatively similar to what we report in Table 8.

[28] We also estimate Eq. (7) using 2SLS where we instrument CSR_t and CSR_t* $GOODGOV_t$ (separately) using the BLUESTATE variable as defined earlier. Results are qualitatively similar to what we report in Table 9.

Table 9
The effect of corporate governance.

	LETHINDEX	HFININDEX	SUSTAINABILITY	HNUMBOARDS	HFEAMLE	HANALYSTFOLLOWING
Intercept	−5.944**	−5.426***	−5.134***	−4.495***	−4.258 ***	−5.260***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
CSR	0.108***	0.068***	0.103***	0.034**	0.093***	0.032*
	(0.00)	(0.00)	(0.00)	(0.05)	(0.00)	(0.10)
LETHINDEX	0.096*					
	(0.06)					
*CSR*LETHINDEX*	0.036**					
	(0.05)					
HFININDEX		0.101*				
		(0.09)				
*CSR*HFININDEX*		0.113***				
		(0.00)				
SUSTAINABILITY			0.218***			
			(0.00)			
*CSR*SUSTAINABILITY*			0.058***			
			(0.01)			
HNUMBOARDS				0.277***		
				(0.00)		
*CSR*HNUMBOARDS*				0.133***		
				(0.00)		
HFEMALE					0.108**	
					(0.05)	
*CSR*HFEMALE*					0.065***	
					(0.00)	
HANALYSTFOLLOWING						0.199***
						(0.00)
*CSR*HANALYSTFOLLOWING*						0.126***
						(0.00)
Control Variables	INCLUDED	INCLUDED	INCLUDED	INCLUDED	INCLUDED	INCLUDED
Board Characteristics	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed Effect	Year&Firm	Year&Firm	Year&Firm	Year&Firm	Year&Firm	Year&Firm
Adjusted R^2	0.42	0.42	0.47	0.42	0.42	0.42
# Observations	14,723	14,723	14,723	14,723	14,723	14,723

This table presents the results for the effects of board characteristics and external governance mechanism on VEGA, using OLS regressions. The dependent variable is the leading Vega ($VEGA_{t+1}$) for all models. Internal corporate governance variables include LETHINDEX (equals one if ETHINDEX is below median 9.965, meaning more diversity in ethnicity, zero otherwise), HFININDEX (one if FININDEX is greater than median 9.567, meaning more financial experts, zero otherwise), SUSTAINABILITY (one if a firm has a sustainability/CSR committee, zero otherwise), HNUMBOARDS (one if NUMBOARDS is greater than the median 10.056, zero otherwise), and HFEMALE (one if PCT_FEMALE is greater than the median 10.039, zero otherwise). The external governance mechanism considered is HANALYSTFOLLOWING (one if ANALYSTFOLLOWING is greater than the median 9, zero otherwise). All variables are defined in Appendix B. Coefficient estimates (*p*-values) are provided in the top (bottom) row. The superscripts *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed test), respectively.

findings raise questions regarding the interpretation of evidence in the literature. Interestingly, while CEO risk-taking incentives dampen the risk-reducing effect of CSR, they do not eliminate or reverse the effects. Overall, we believe future empirical research on the relation between CSR status and firm risk should be mindful of potential moderating effects of executive incentives.

Our study also informs the on-going debate on whether CSR is value maximizing. The contradicting findings in the large literature on the CSR-firm value relation may be driven by whether firms can identify the economic benefits of CSR (for example, the risk management perspectives of CSR) and more importantly, take actions to realize them. In our case, to maximize shareholder value, firms should actively respond by adjusting executive risk incentives to take advantage of the new risk capacity created by CSR.

While we believe our study shows a strong connection between CSR standing and CEO Vega, we acknowledge that some limitations remain. First, as with most empirical studies in this area, unobserved factors could explain our results. However, our results persist after including a variety of fixed effects, lagged dependent variable, IV models, and a series of robustness checks. Also, reverse causality and the mechanical relation between Vega and risk bias against finding our results. Our analyses on CSR strengths versus concerns and other CSR measures tell a consistent story. While conceivable, it is difficult to find a self-selection or spurious relation story that generates all these results. Second, our work assumes a strong negative connection between CSR standing and firm risk. Future research should attempt to more clearly identify situations to see if implications of our risk-capacity hypothesis hold. Finally, while we provide evidence on how firms adjust CEO compensation contracts in response to risk environment, the setting of CSR is not exogenous. Future research can explore truly exogenous settings, such as regulatory changes or pandemic shocks, to further examine this question.

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Appendix A. Corporate social responsibility categories

Category	Strength	Concern
Community	Charitable giving	Investment controversies
	Innovative giving	Community impact
	Support for housing	Tax disputes
	Non-US charitable giving	Other concerns
	Volunteer programs	
	Community engagement	
	Other strengths	
Diversity	CEO- gender or minority	Workforce diversity
	Promotion	Non-representation
	Board of directors	Board of directors – minorities
	Work-life benefits	Board of directors – gender
	Women and minority contracting	Other concerns
	Employment of the disabled	
	Gay and lesbian policies	
	Employment of underrepresented groups	
	Other strengths	
Employee Relations	Union relations	Union relations
	No-layoff policy	Employee health and safety
	Cash profit sharing	Workforce reductions
	Employee involvement	Retirement benefits concern
	Retirement benefits strength	Supply chain concern
	Health and safety strength	Child labor
	Supply chain policies, programs and initiatives	Labor-management relations
	Compensation and benefits	
	Employee relations	
	Professional development	
	Human capital management	
	Other strengths	
Environment	Beneficial products and services	Hazardous waste
	Pollution prevention	Regulatory compliance
	Recycling	Ozone depleting chemicals
	Clean energy	Toxic spills and releases
	Property, Plant and Equipment	Agriculture chemicals
	Management system strength	Climate change
	Water stress	Impact of products and services
	Biodiversity and land use	Biodiversity and land use
	Raw material sourcing	Operational waste
	Other strengths	Supply chain management
		Water management
		Other concerns
Product	Quality	Product quality and safety
	R&D innovation	Marketing and advertising
	Benefits to economically disadvantaged	Anticompetitive practices
	Access to capital	Customer relations
	Other strengths	Other concerns

Appendix B. Variables definition and data sources

Variables	Definition	Data sources
CSR Variables		
CSR	Net score of CSR rating (total strengths subtracting total concerns), based on five categories of KLD rating data, i.e., community, diversity, employee relations, environment, and product;	KLD database
STRENGTH	The sum of all strength scores, based on five categories of KLD rating data, i.e., community, diversity, employee relations, environment, and product;	KLD database
CONCERN	The sum of all concern scores, based on five categories of KLD rating data, i.e., community, diversity, employee relations, environment, and product;	KLD database
COMS	Net score of CSR rating (total strengths subtracting total concerns), based on one category of KLD rating data, i.e., community;	KLD database
DIVS		KLD database

	Net score of CSR rating (total strengths subtracting total concerns), based on one category of KLD rating data, i.e., diversity;	
EMPS	Net score of CSR rating (total strengths subtracting total concerns), based on one category of KLD rating data, i.e., diversity;	KLD database
ENVS	Net score of CSR rating (total strengths subtracting total concerns), based on one category of KLD rating data, i.e., environment;	KLD database
PROS	Net score of CSR rating (total strengths subtracting total concerns), based on one category of KLD rating data, i.e., product;	KLD database
HUMS	Net score of CSR rating (total strengths subtracting total concerns), based on one category of KLD rating data, i.e., human rights.	KLD database
CEO Incentive Variables		
DELTA	Dollar change in the value of CEO's annual equity-based compensation for a 1% change in the stock price (in $000 s);	Coles et al. (2006) and Dr. Naveen's website https://sites.temple.edu/lnaveen/data/
VEGA	Dollar change in the value of CEO's annual equity-based compensation associated with a 0.01 change in the annualized standard deviation of the firm's returns (in $000 s).	Coles et al. (2006) and Dr. Naveen's website https://sites.temple.edu/lnaveen/data/
OPTION	Log transformation of the amount of options granted in a specific year;	ExecuComp Database
OPTIONVALUE	Log transformation of the value of options granted using Black-Scholes Model.	ExecuComp Database
DUALITY	1 if the CEO is also the Chairman of BOD, 0 otherwise	ExecuComp Database
TENURE	The number of years the executive has been CEO at this firm	ExecuComp Database
AGE	CEO's age	ExecuComp Database
OWNERSHIP	The percentage of shares owned by the executive	ExecuComp Database
FEMALE	1 if the CEO is a female, 0 if CEO is a male	ExecuComp Database
CASH COMPENSATION	CEO's cash compensation, which is the sum of salary and bonus	ExecuComp Database
Board Variables		
ETHINDEX	The Herfindahl index of ethnicity (categorized as White/Caucasian, African American, Asian, Hispanic, and other)	ISS (formerly Riskmetrics) Database
FININDEX	The number of finance experts divided by the number of directors	ISS (formerly Riskmetrics) Database
NUMBOARDS	The average number of outside board seats	ISS (formerly Riskmetrics) Database
PCT_FEMALE	Percentage of female directors in the board	ISS (formerly Riskmetrics) Database
BOARDSIZE	The number of directors in the board	ISS (formerly Riskmetrics) Database
INDEPENDENCE	The number of independent outside directors divided by the board size	ISS (formerly Riskmetrics) Database
CO-OPTED	The percentage of directors appointed after the CEO assuming the role	Coles et al. (2014) and Dr. Naveen's website https://sites.temple.edu/lnaveen/data/
SUSTAINABILITY	Takes on the value of 1 if a firm having a sustainability/CSR committee and 0 otherwise	BOARDEX
Other Governance Var.		
ANALYSTFOLLOWING	The number of analysts following a firm	IBES
EINDEX	Entrenchment index measuring a firm's corporate governance, which include considerations of staggered board, limitation on amending bylaws, limitation on amending the charter, supermajority to approve a merge, golden parachute and poison pill. Eindex takes the value from 0 to 6, with 6 representing highest level of entrenchment.	Bebchuk et al. (2009) Bebchuk's research website
GINDEX	A corporate governance index that incorporates 24 equally weighted elements measuring takeover defenses.	Gompers et al. (2003)
Other Variables		
Q	The firm–year Tobin's Q, which is computed as the sum of the book value of total assets plus the market value of common stock less the book value of equity over the book value of assets;	Compustat
INSTHOLD	Percentage of institutional share ownership	ThomsonReuters (CDS/Spectrum 13 (f) filings)
ROA	Return on assets	Compustat
LEVERAGE	Total liabilities over total assets	Compustat
CAPEX	Capital expenditures over total assets	Compustat
SIZE	Log of total assets at the end of the fiscal period	Compustat
Z-SCORE	Altman's Z score = 1.2 (working capital/total assets) + 1.4(retained earnings/total assets) + 3.3 (earnings before interest and taxes/total assets) + 0.6(market value of equity/book value of total liabilities) + 0.999(sales/total assets)	Compustat
CREDITRATING	The S&P credit rating from AAA (24) to D (1)	Compustat
YEAR	Year dummies for the period from 1992 to 2010;	Compustat
INDUSTRY	Industry dummies, petroleum (SIC codes 13, 29), consumer durables (SIC codes 30, 36, 37, 50, 55, 57), basic industry (SIC codes 8, 10, 12, 14, 24, 26, 28, 33), food and tobacco (SIC codes 20, 21, 54), construction (SIC codes 15, 16, 17, 32), capital goods (SIC codes 34, 35, 38, 39), transportation (SIC codes 40, 41, 42, 44, 45, 47), textiles and trade (SIC codes 22, 23, 51, 53, 56, 59), services (SIC codes 7,	Compustat

73, 75, 80, 82, 83, 87, 96), leisure (SIC codes 27, 58, 70, 79), unregulated utilities (SIC code 48), regulated utilities (SIC code 49), and financials (SIC codes 60, 61, 62, 63, 65, 67).

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