

A DUAL AGENCY VIEW OF BOARD COMPENSATION: THE JOINT EFFECTS OF OUTSIDE DIRECTOR AND CEO STOCK OPTIONS ON FIRM RISK[†]

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This paper contributes to multiple agency theory by examining how the compensation schemes awarded to outside directors and the CEO jointly affect firm-level risk taking. Using data of the S&P 1500 firms from 1997 to 2006, we find support for earlier arguments that providing the CEO, the outside directors, or both with stock options increases risk taking. More importantly, we find that compensating outside directors with stock options has significantly stronger effects than CEO stock options. Finally, contrary to what one would expect, we find that these effects are mutually substituting; that is, if both the outside directors and the CEO are provided with stock option compensation, outside directors' incentives weaken the effect of the CEO's incentives on firms' risk taking. Copyright © 2010 John Wiley & Sons, Ltd.

INTRODUCTION

While the effects of chief executive officer (CEO) compensation on firm risk taking have attracted a lot of attention in the recent literature (e.g., Devens *et al.*, 2007; Harford, and Li, 2007; Larraza-Kintana *et al.*, 2007; Sanders and Hambrick, 2007; Williams and Rao, 2006), the effects of the compensation schemes of boards and, in particular, outside directors have received much less emphasis (Cyert, Kang, and Kumar, 2002; Deutsch, Keil, and Laamanen, 2007; Hermalin and Weisbach, 1991; Hoskisson *et al.*, 2002; Kor, 2006; Linn and Park, 2005). Most studies tend to take an instrumental perspective in which boards are seen as a mechanism to monitor and control managerial

behavior and occasionally provide strategic advice when needed (Kemp, 2006; Ruigrok, Peck, and Keller, 2006). Independent directors are seen as protecting the interests of shareholders by objectively reviewing management's decisions (Eisenhardt, 1989; Tihanyi *et al.*, 2003) and by actively monitoring the performance of the CEO (e.g., Boyd, 1994; Rechner and Dalton, 1991).

However, instead of being mere monitors or strategy consultants to the CEO, the outside directors should be understood as agents in their own right. They are powerful individuals, present or former CEOs, representatives of institutional blockholders, or top professionals that have their own individual motives as members of the board. Recognizing the presence of multiple agencies, the key question of the optimal design of compensation contracts becomes how to reach alignment. What are the relative effects of the incentives provided to the CEO and outside directors on firms' risk taking? How do the compensation schemes of the CEO and outside directors interact given that the risk preferences of the CEO and the outside

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directors might differ and that the two parties have different roles?

By focusing on these questions, our paper contributes to multiple agency theory, which has emerged to examine the applicability of traditional agency theory arguments from one principal-one agent contexts to many-to-many relationships (e.g., Arthurs *et al.*, 2008). While earlier multiple agency research has examined the different motives of pension funds and professional investment funds (Hoskisson *et al.*, 2002) and the differences in the motives of executive directors and venture capitalists (Arthurs *et al.*, 2008), we apply it to a more general two agent-one principal situation to explain firm-level risk taking.

After the early studies of Kosnik (1987, 1990), corporate governance research has gradually shifted toward viewing outside directors as engaged actors (Borokhovich, Parrino, and Trapani, 1996; Deutsch, 2005; Hermalin and Weisbach, 1991; Johnson, Hoskisson, and Hitt, 1993). Yet, so far there are no studies that have examined the relative effects of contingent compensation contracts on outside directors and the CEO or the joint effects of such contracts on risk taking. Prior research on outside directors has primarily emphasized that outside directors need to be compensated appropriately, and calls have been made to extend stock-based compensation schemes to outside directors (e.g., Carey, Elson, and England, 1996). Therefore, on the basis of the prior research, we do not know whether the incentives provided to the CEO and outside directors are complements or substitutes and arguments for forms of interaction can be made (e.g., Rediker and Seth, 1995).

Our paper contributes to an improved understanding of multiple simultaneous compensation schemes in a multiple agency setting by examining the interaction effects of CEO and outside director compensation schemes on firm-level risk taking. By analyzing the effects of stock option compensation for outside directors and CEOs in Standard & Poor's (S&P) 1500 firms between 1997 and 2006, we provide empirical evidence of the incentive effects of both. Consistent with the predictions of traditional agency theory, our findings show that stock option compensation increases firm-level risk taking, irrespective of the agent. More importantly, we find that the effect is significantly stronger for outside directors than for the CEO. Finally, we find that the effects of outside director compensation and CEO compensation are mutually substituting,

implying that the higher the level of outside directors' stock option compensation, the weaker the effect of paying the CEO with stock options on the firm's risk taking and vice versa.

THEORY AND HYPOTHESES

A large part of the research on corporate governance and firms' risk taking has been focused on the role of the CEO. Grounded in a bilateral agency model (Fama and Jensen, 1983; Jensen and Meckling, 1976), this research has argued that the CEO is the central actor in strategic decision making since he or she initiates and implements strategic decisions. A central insight of this model is that one potential conflict of interest emerges between the CEO (the agent) and the shareholders (the principal), stemming from differences in their ability to diversify the risks associated with the firm and their resulting propensity for risk taking (Fama, 1980; Fama and Jensen, 1983; Jensen and Meckling, 1976).

Agency theorists argue that, in principle, shareholders can easily diversify their shareholdings and therefore can be expected to be risk neutral, willing to undertake any project that might result in a positive net present value, regardless of its risk level. CEOs, on the other hand, are viewed as risk averse and opportunistic. CEOs' risk aversion stems from the fact that they are faced with the risk of losing their jobs when undertaking risky projects. They are unable to diversify their income streams and may face personal liability in the case of corporate insolvency or financial distress (Beatty and Zajac, 1994; Coffee, 1988; Eisenhardt, 1989; Hoskisson, Hitt, and Hill, 1993). They are expected to be biased against projects that entail high levels of risk, even when these projects would have a positive net present value. CEOs are further expected to be opportunistic, avoiding effort that cannot be easily monitored. As a result of these behavioral assumptions about shareholders and the CEO, an inherent conflict of interest, referred to as the *principal agency problem*, exists between the CEO and the shareholders.

To alleviate conflicts of interest, different compensation schemes have been developed to align the interests of the CEO and the shareholders. For example, compensating the CEO with stock should cause this kind of alignment as the CEO also becomes a shareholder. However, since CEOs

already have a nondiversifiable employment stake in the firm, receiving stock would lead to an even larger nondiversifiable position and potentially even more risk-averse behavior (Kahl, Liu, and Longstaff, 2003; Miller, Wiseman, and Gomez-Mejia, 2002; Sanders, 2001). In line with this argument, in situations where management has been able to trade the company's stock, it has been found that it tends to reduce managerial ownership in the company—contrary to what the incentive was originally intended to do (Ofek and Yermack, 2000). In a recent study, Devers *et al.* (2008) also found that restricted stock reduced the propensity of CEOs to take strategic risks.

Stock option-based compensation schemes partially overcome this problem because the downside of stock options is limited (Coles, Daniel, and Naveen, 2006; Dee, Lulseged, and Nowlin, 2005; Ross, 2004; Williams and Rao, 2006). Stock options provide CEOs with the right to buy shares at prespecified times and prices, yet they are not required to do so. There is also empirical evidence that stock options do indeed increase risk taking (e.g., Coles *et al.*, 2006; Devers *et al.*, 2007; Sanders and Hambrick, 2007; Williams and Rao, 2006; Wright *et al.*, 2007) even to the extent that they have actually been found to be related to misreporting and financial fraud (Burns and Kedia, 2006; Donoher, Reed, and Storrud-Barnes, 2007; Goldman and Slezak, 2006; Harris and Bromiley, 2007). Recently, growing suspicion of stock option incentives has even caused many firms to abandon their stock option incentive programs. There is a need to better understand how to use stock option incentives so that their potentially negative side effects are minimized.

In addition to providing CEOs with stock-based incentives, aligning their actions with shareholders' interests could also be achieved through the active involvement of the board of directors (Fama and Jensen, 1983). In its early days, agency theory took an instrumental view of boards, arguing that the board and, in particular, outside directors might be in a position to protect the interests of shareholders by actively evaluating managerial performance (e.g., Boyd, 1994; Rechner and Dalton, 1991) and by ensuring that a firm's management formulates effective strategies (Eisenhardt, 1989; Tihanyi *et al.*, 2003). Some studies even viewed control by the board as a substitute for compensating the CEO with stock-based incentives (Rediker and Seth, 1995). More recent studies,

however, have suggested that they may in fact be complements. According to Hoskisson, Castleton, and Withers (2009), increased monitoring intensity shifts risk to managers, who then over time require higher incentives to compensate for their higher career and employment risk.

Given this instrumental view of boards, much of the early literature on boards focused on the question of whether they play an active role at all (Baysinger and Hoskisson, 1990; Baysinger, Kosnik, and Turk, 1991; Fama and Jensen, 1983; Hill and Snell, 1988; Kosnik, 1987; Mace, 1986; Zajac and Westphal, 1996) and how to get outside directors more actively involved (Johnson *et al.*, 1993). However, monitoring and control are only two of the potentially many tasks of the board. More recent research has therefore examined the involvement of boards in different sets of tasks (Conyon and Peck, 1998; Gulati and Westphal, 1999; Hillman and Dalziel, 2003; Huse, 2007; Johnson *et al.*, 1993; Judge and Zeithaml, 1992; Shen, 2003; Sundaramurthy and Lewis, 2003) and broadened the set of underlying theoretical perspectives. For instance, research into boards' strategic tasks has combined agency and resource dependence theories (Hillman and Dalziel, 2003) to argue that, in addition to their basic monitoring task, outside directors represent valuable resources for the firm (e.g., Peng, 2004). They can provide valuable strategic advice and contribute significantly to shaping the strategy and transformation of a firm (e.g., Golden and Zajac, 2001).

While these studies have increased our knowledge of the power dynamics and interactions between the CEO and the board, most have not explicitly considered outside directors' own incentives and risk preferences. Rather, these studies have built on the basic assumption of a risk-averse CEO and risk-neutral outside directors and shareholders. Relatively little attention has been paid to what incentives would motivate outside directors to fulfill their monitoring role or take on a more strategically active role (Cyert *et al.*, 2002). In one of the few studies on the topic, Deutsch *et al.* (2007) find that performance-based incentives for outside directors can affect a firm's acquisition behavior. Moreover, different kinds of incentives have been found to have different effects. Hoskisson *et al.* (2002) found that inside directors with equity tend to emphasize internal innovation, and outside directors with equity tend to emphasize external innovation. They noted that the owners

do not necessarily always have a unified voice. Owners are not necessarily even risk neutral. For example, family-owned firms tend to be more risk averse and firms owned by activist investors tend to be more risk seeking than large public firms with dispersed ownership.

The scarcity of research that addresses outside directors' incentives might result from the fact that these incentive mechanisms are potentially subject to major conflicts of interest (Yermack, 2004), making theoretical predictions less straightforward. According to U.S. legislation, boards generally set their own compensation (Goodman and Olson, 2007). However, institutional owners and corporate governance activists have promulgated standards for board compensation through a mix of direct meetings, shareholder resolutions, and media campaigns against companies that they target for poor governance (Carey *et al.*, 1996; Yermack, 2004). Given these countervailing forces, at the moment it is unclear whether paying the outside directors with stock options can endanger a board's monitoring role. Moreover, given the dearth of research, the combined effect of compensating both the CEO and outside directors on the actions of these two agents is poorly understood. To improve our understanding of these questions, we next develop a set of hypotheses on the impact of CEOs' and outside directors' stock option compensation, as well as their joint effect on a firm's risk taking.

Stock option compensation of the CEO and a firm's risk taking

Our baseline hypothesis is the well-established argument by agency theorists that CEOs who receive stock option compensation are more likely to make riskier decisions since they participate in the upside potential of these decisions but not in their downside (Agrawal and Mandelker, 1987; Sanders, 2001). This argument has received widespread support in the empirical literature (e.g., Devers *et al.*, 2008; Rajgopal and Shevlin, 2002; Williams and Rao, 2006; Wright *et al.*, 2002). We hypothesize:

Hypothesis 1: Stock option compensation to the CEO is positively related to risk taking.

Stock option compensation of outside directors and a firm's risk taking

Research on the effects of the stock option compensation of outside directors is relatively scarce. Therefore, we start by extending the agency logic that has been developed and tested in research on CEO compensation. Following this logic, outside directors can be viewed as self-interested agents who also have to be provided with incentives to align their interests with those of the shareholders. Stock options should provide outside directors with such incentives to increase their involvement in various board tasks, steering a firm's decision making toward higher risk taking (Linn and Park, 2005; Yermack, 2004).

While the underlying argument for the effects of stock option compensation for outside directors is similar to CEO stock option compensation, it is important to take the differences between outside directors and CEOs into consideration. One important difference is that outside directors often possess alternative income streams and are therefore less dependent on the income they receive from the focal firm. This diversification of income streams should make them considerably less risk averse than CEOs. However, where executives are concerned about employment risk and undiversified income streams, outside directors are concerned about the effect of strategic decisions on their personal reputation and potential personal liability (Zajac and Westphal, 1996) and are subject to CEO influence. Strategic actions that create significant risks for the firm might harm the reputation of an outside director if these risks are realized. For instance, directors of firms that face bankruptcy or debt restructuring subsequently hold significantly fewer board positions (Gilson, 1990). Outside directors are also highly concerned about stockholder suits (Judge and Zeithaml, 1992; Kesner and Johnson, 1990). Since CEOs personally have a lot at stake, they are likely to engage in different kinds of social influence tactics to affect the board's risk-taking preferences (Golden and Zajac, 2001; Gulati and Westphal, 1999; Westphal, 1998). Finally, the process with which new board members are selected might skew the risk preferences of outside directors away from risk taking (Hermalin and Weisbach, 1998). Taken together, we expect the outside directors to be more risk averse on average than shareholders, but less risk averse than the CEO. Thus, we hypothesize that

stock option compensation to outside directors increases risk taking more than stock option compensation to the CEO.

Hypothesis 2: Stock option compensation to outside directors is more strongly positively related to a firm's risk taking than stock option compensation to the CEO.

The interaction of CEO and outside director stock option compensation

Even though agency theory suggests that both CEOs and outside directors should react to stock option compensation by steering the corporation toward higher risk taking, the predictions on the combined effect are less clear-cut. One line of reasoning suggests that CEO and outside director compensation have complementary, mutually strengthening effects. For example, in the corporate governance literature, scholars suggest that different governance mechanisms frequently work in tandem to align agent behavior with shareholder preferences (Berry, Fields, and Wilkins, 2006).

When compensated with stock options, the CEO might end up proposing highly risky strategic moves for the firm, and if the directors are not equally compensated with stock options, they might have an incentive to turn down these proposals. With incentives to increase the risk level of the firm, the outside directors might even take an active role and provide the top management team with advice on additional strategic moves that could further increase the risk level of the firm. Research has found, for instance, that outside directors can make the management team aware of potential acquisition targets (Westphal, Seidel, and Stewart, 2001). Consistent with this finding, it has been found that governance mechanisms such as the market for corporate control, insider shareholdings, and the proportion of outside directors positively interact in predicting merger and acquisition activity (Agrawal and Knoeber, 1996). Thus we hypothesize:

Hypothesis 3a: Paying outside directors with stock options will have a positive effect on the relationship between CEO stock option compensation and a firm's risk taking.

An alternative line of reasoning (Dalton *et al.*, 2003; Rediker and Seth, 1995) suggests that these

two mechanisms for reducing the principal-agent conflicts might act as substitutes. In this case, appropriate increases in the level of risk taking would be reached through incentives provided either to the CEO or outside directors. Once the CEO's goals are aligned with those of the shareholders, increasing outside director stock options might do little to further increase risk taking and vice versa, since the additional incentives are essentially redundant (Jensen, Solberg, and Zorn, 1992).

The implicit assumption in the substitution argument is that the conflict between shareholders and managers can be resolved in multiple ways. This is analogous to Rediker and Seth's (1995) analysis of the monitoring potential of the board. They argued that: (1) the more monitoring was performed by large shareholders, the lower the monitoring potential of the board of directors; (2) the higher the incentive effects of managerial share ownership, the lower the monitoring potential of the board of directors, and (3) the higher the potential for mutual monitoring among management, the lower the monitoring potential of the board of directors.

In a similar manner, our hypothesis could be formulated as stating that the higher the management's motivation to increase the risk level of the firm, the lower the need to motivate outside directors to enhance the firm's risk. Thus, in line with the substitution logic, we hypothesize the following negative interaction:

Hypothesis 3b: Paying outside directors with stock options will have a negative effect on the relationship between CEO stock option compensation and a firm's risk taking.

METHODS

Sample and data

To test our hypotheses, we compiled a panel dataset of 1500 firms for the years 1997 to 2006 from four archival data sources. We included in our dataset any firm that was listed on the S&P 1500 in any of those years and on which relevant data were available from these sources. We chose this broad definition for our sample because the S&P 1500 includes a wide variety of industries, thereby reducing potential industry and survival biases as much as possible.

We collected data on outside directors' and CEOs' compensation from S&P ExecuComp database, which collects companies' proxy statements. The data comprised information on director and executive compensation for a large number of the S&P 1500 firms during the study period. We collected accounting and financial data from the Compustat database. Data on board composition, officer and outside director ownership, and institutional ownership were drawn from the Corporate Governance Service at the Investor Responsibility Research Center (IRRC), which collects data on corporate governance issues for North American corporations. Finally, we also extracted stock price data from the Center for Research in Security Prices (CRSP) database.

Combining these four data sources yielded a total of 6,175 company years. A loss of data results from missing data on outside directors' compensation and on board composition, as well as from lagging the independent variables. After merging the databases and lagging the independent variables, our analysis was based on an unbalanced panel dataset on 1,165 firms, with an average of 5.3 years per firm.

Dependent variable

In this study, our main dependent variable is firm-level risk. After reviewing a wide variety of measures of risk used in the prior research, we chose the ratio of a firm's book value of common equity to its market value as our main measure (Fama and French, 1992). Although its role was debated heavily in the 1990s (e.g., Lakonishok, Shleifer, and Vishny, 1994; LaPorta *et al.*, 1997), *book equity to market equity* has been shown to be a strong proxy for sensitivity to risk factors in returns, and its use has been proposed in finance research instead of beta (Fama and French, 1995, 1996a, 1996b). We calculate the ratio of *book equity to market equity* on a yearly level at the end of each fiscal year.

In order to test the robustness of our results with alternative measures, we also ran our analyses with *beta* and *capital expenditure per employee*. Although the use of beta has been increasingly criticized both in finance and strategy research (e.g., Fama and French, 1992; Ruefli, Collins, and Lacugna, 1999), we use it in our analyses to show the consistency of our results with earlier studies. Moreover, we also use capital expenditure per employee, which has been used as a risk measure

in the most recent research (e.g., Devers *et al.*, 2008).

Independent variables

Our independent variables are *the CEO's stock option compensation* and *outside directors' stock option compensation*. We defined *the CEO's stock option compensation* as the value of stock options that were granted to the CEO during a firm's fiscal year. The CEO's stock option compensation was derived from the S&P ExecuComp database. We determined the value of *outside directors' stock option compensation* by multiplying the number of stock options granted to an outside director during a firm's fiscal year by the average value of a firm's stock options granted to the company's executives during that fiscal year. The value of a stock option is determined using the standard Black and Scholes (1973) option valuation equation—one of the two alternatives approved by the U.S. Securities and Exchange Commission (SEC) to evaluate stock options (Sanders, 2001). We made this choice because the Black and Scholes method is the most commonly used and there is also evidence that values derived using the two methods are highly correlated (Lambert, Larcker, and Weigelt, 1993; Sanders, Davis-Blake, and Fredrickson, 1995).

Recent research has made the important observation that when examining the effects of stock options on risk taking, one should study the effects of exercisable and unexercisable stock options separately (Devers *et al.*, 2008). We considered this separation carefully in connection with our analyses, but decided to leave it for future, finer-grained research, since we are mainly interested in the relationship between stock options and risk taking, and we noted that this basic relationship did not differ much between exercisable and unexercisable stock options (Devers *et al.*, 2008: 559, Fig. 1.). We do not expect this aggregation of both types of options to cause major bias in our results.

Control variables

We included several control variables in our model to rule out competing explanations for our results. We control for *institutional investors' holdings* because institutional investors have the ability and incentive to proactively monitor managerial actions (Hansen and Hill, 1991; Sundaramurthy, 1996). Although recent research has discovered

that different types of institutional investors are likely to affect firms' behaviors differently (Hoskisson *et al.*, 2002; Zahra, Neubaum, and Huse, 2000), a lack of sufficiently fine-grained data on different institutional investor types forced us to settle for more aggregate controls used in the prior literature (Hansen and Hill, 1991; Kor, 2006; Sundaramurthy, 1996). Since equity ownership may also align their interests with those of stockholders (Jensen and Meckling, 1976; Mallette and Fowler, 1992; Ross, 1973), we include a control variable for *officers' and outside directors' holdings* in our model (Zahra *et al.*, 2000).

We control for *company size*, because it has been found to affect firms' risk taking (e.g., Miller *et al.*, 2002) and different governance mechanisms play out differently in firms of different sizes (Rediker and Seth, 1995). Here we use a commonly used measure for *company size*, the log of sales (Miller *et al.*, 2002). We also control for *firm performance* because it may affect the willingness of decision makers to adopt risky strategies. For example, *firm performance* is likely to affect the motivation to pursue acquisitions (Haunschild, 1993; Sanders, 2001). We include firms' total return per share (dividends reinvested) in our analyses to control for *firm performance*. We also include the *current ratio* to control for firms' ability to service their short-term debts over the next 12 months.

We include three further control variables that are typically found in studies on boards (Finkelstein and Mooney, 2003). These are the *proportion of outside directors*, *separation of the CEO's and chairman of the board's position*, and *board size*.

Prior research suggests that the higher the number of outside directors on boards, the more likely they are to monitor management vigilantly (Hayward and Hambrick, 1997; Hermalin and Weisbach, 1991, 1998) and the less likely they will be to succumb to pressures from the CEO (Borokhovich *et al.*, 1996). The *proportion of outside directors* is therefore measured as the percentage of nonexecutive directors on the board (Buchholtz and Robbins, 1994; Dalton *et al.*, 1998; Goodstein, Gautam, and Boeker, 1994).

In addition to a high proportion of outside directors, the *separation of the CEO's and chairman of the board's position* has also been identified as a measure of a board's independence and is nowadays commonly recommended in different corporate governance guidelines (Brickley, Coles,

and Jarrell, 1994; Dahya, McConnell, and Travlos, 2002; Finkelstein and D'Aveni, 1994; Rechner and Dalton, 1991). We use a dummy variable coded as 0 if the positions of the CEO and the chairman of the board are separated, and coded as 1 otherwise.

Prior research has also suggested that smaller boards might monitor management more vigilantly (Zahra *et al.*, 2000) and protect shareholder interests more effectively (Yermack, 1996). We therefore include the number of members of the board as a measure for *board size*. Finally, year dummies are also incorporated into the models to account for differences across time. The use of time dummies is important when analyzing cross-sectional dominated datasets to control for potential contemporaneous correlation (Certo and Semadeni, 2006).

ANALYSES

We first carried out our analyses using a standard panel regression specification. However, because of an anonymous reviewer's advice relating to the potential problems of heteroskedasticity and autocorrelation, we decided to switch to cross-sectional time series regression specification using Stata's XTSCC module (Hoechle, 2007), which has been used earlier, for example, in finance research (e.g., Hoechle and Schmid, 2009). XTSCC allows us to estimate fixed-effects regression models with Driscoll and Kraay standard errors (Driscoll and Kraay, 1995, 1998). The econometric issue that the Driscoll and Kraay standard errors address is that in many empirical applications involving combined time series and cross-sectional data the residuals from different cross-sectional units are correlated with one another. The presence of such spatial correlations in residuals complicates standard inference procedures since they typically require the assumption that the cross-sectional units are independent (Driscoll and Kraay, 1995). We chose the Driscoll and Kraay standard errors since they are robust to the heteroskedasticity, autocorrelation, and cross-sectional dependence (Driscoll and Kraay, 1998; Hausman, 1978; White, 1980) that we found to be present in our data set. The results with Driscoll and Kraay robust standard errors are, however, also consistent with our original non-reported results of standard random-effects panel regressions.

RESULTS

In Table 1, we present descriptive statistics including means, standard deviations, and correlations. The average book to market in our sample was 0.46, with a standard deviation of 0.88, and the average beta was 1.02, with a standard deviation of 0.52. The average capital expenditure per employee was \$31.560, with a standard deviation of 124,000. CEO compensation in stock options was considerably higher than that of the outside directors. While CEOs received on average more than \$3.24 million in stock options, outside directors received on average only around \$59,000 in stock options. We do not anticipate multicollinearity problems, as the largest correlation in our sample is 0.51 (between *firm size* and *board size*), a value that is clearly below the common accepted 0.7 threshold, and all other correlations are rather low.

Table 2 summarizes the results of our regression analyses with firms' *book equity to market equity* as the dependent variable. We first present a baseline model with the control variables only (Model 1). Among the control variables, we find that *firm size* exhibits a highly significant positive relationship ($p < 0.001$) with *book equity to market equity*. Similarly the *officers' and outside directors' holdings* ($p < 0.05$) and the *proportion of outside directors* ($p < 0.10$) also have a significant or almost significant positive effect on risk taking. Finally, we also included a one-year lagged *book equity to market equity* ($t - 1$) in the regression to control for the momentum effects of the dependent variable. As expected, it is also positively related to the next year's *book equity to market equity* ($p < 0.10$).

In Models 2 and 3 we examine the effects of *CEO's options* and *directors' options* by entering these independent variables into the baseline model one at a time. Finally, Model 4 provides the full model, which includes the two main effects and an interaction term, *CEO's options x director's options*. The results broadly support our hypotheses.

In Hypothesis 1, we predicted that paying the CEO with stock options is positively related to a firm's risk taking. Although the result of Model 2 provides no support, Model 4 suggests a positive relationship ($p < 0.05$), providing some support for our first hypothesis.

Table 1. Descriptive statistics and correlations

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12
1 Beta	1.02	0.52												
2 Book equity to market equity	0.46	0.88	-0.06											
3 Capital expenditure per employee	31.56	124.00	-0.05	0.01										
4 Current ratio	2.34	2.38	0.31	0.01	-0.07									
5 Board size	8.90	3.96	-0.27	0.00	0.01	-0.27								
6 Officers' and outside directors' holdings	12.10	106.00	0.01	-0.02	-0.01	-0.03	0.07							
7 Institutional holdings	0.57	0.37	0.04	-0.03	0.03	-0.01	0.01	-0.03						
8 Firm size	7.47	1.54	-0.21	-0.05	-0.01	-0.43	0.51	0.16	0.05					
9 Firm performance	23.64	468.00	0.18	-0.03	0.06	0.07	-0.08	-0.01	0.02	-0.03				
10 Outside directors	0.79	0.11	-0.03	-0.01	0.02	-0.16	0.22	-0.03	0.04	0.21	-0.02			
11 CEO duality	0.81	0.39	-0.08	-0.01	-0.02	-0.07	0.13	-0.03	-0.01	0.19	-0.02	0.16		
12 CEO's options	3.24	11.50	0.12	-0.02	0.00	0.03	0.00	0.05	-0.01	0.15	0.07	0.00	0.05	
13 Directors' options	0.06	0.12	0.30	-0.04	0.00	0.21	-0.19	0.04	0.01	-0.09	0.07	-0.02	0.20	

N = 5,876 firm-year observations.
All independent variables are in t = -1

Table 2. Regression analysis with *book equity to market equity* as the dependent

	Dependent: book equity to market equity			
	1	2	3	4
Book equity to market equity (t-1)	2.015† (1.17)	2.014† (1.171)	2.025† (1.174)	2.027† (1.175)
Current ratio	0.007 (0.004)	0.007 (0.004)	0.006 (0.005)	0.005 (0.005)
Board size	0 (0.003)	0 (0.003)	0 (0.003)	0.001 (0.003)
Officers' and outside directors' holdings	0.000* (0)	0.000* (0)	0.000* (0)	0.000* (0)
Institutional holdings	0.013 (0.014)	0.013 (0.017)	0.013 (0.015)	0.015 (0.015)
Firm size	0.150*** (0.02)	0.149*** (0.02)	0.141*** (0.019)	0.140*** (0.02)
Firm performance	0.003 (0.002)	0.003 (0.002)	0.003 (0.002)	0.003 (0.002)
Proportion of outside directors	0.188† (0.113)	0.188† (0.114)	0.199† (0.115)	0.201† (0.116)
CEO duality	-0.03 (0.037)	-0.03 (0.037)	-0.034 (0.04)	-0.035 (0.04)
CEOs' options		0.0011 (0.0008)		0.0026* (0.0015)
Directors' options			0.366* (0.208)	0.465* (0.242)
CEOs' options X Directors' options				-0.009* (0.005)
Constant	-1.806** -0.655	-1.800** -0.652	-1.758** -0.629	-1.754** -0.631
N	6.033	6.033	6.033	6.033
Within R ²	0.19	0.19	0.2	0.2
F	31.28***	45.27***	47.93***	51.85***

Unstandardized coefficients; standard errors are provided in parentheses.

† p < 0.10 * p < 0.05 ** p < 0.01 *** p < 0.001

In Hypothesis 2 we predicted that stock option compensation to outside directors is more strongly positively related to a firm's risk taking than stock option compensation to the CEO. Models 3 and 4 provide evidence that paying outside directors with stock options is positively related to a firm's risk taking. The coefficients of *director's options* are positive and statistically significant in both models (Model 3, p<0.05 and Model 4, p<0.05).

In order to examine the comparative strength of the effects of the two compensation schemes, we used the results of Model 4. We compared the partial derivative of outside directors' stock option compensation with respect to firms' risk taking to the partial derivative of CEOs' stock option compensation, using the test routine provided in Stata. Our results indicate that the differences in the slopes as represented by the partial derivations are statistically significant (p<0.05). Thus, our further

analysis supports our hypotheses that the effect on a firm's risk of paying outside directors with stock options is stronger than the effect of paying the CEO with stock options. We also examined this graphically and saw, consistently with the theory, that stock option compensation increases the outside directors' risk propensities significantly faster and with lower amounts of stock options than the risk propensities of the CEOs.

Finally, Model 4 shows the results for our competing Hypotheses 3a and 3b. Hypothesis 3a predicted that the effects of the CEO and outside director stock option compensation are mutually strengthening, suggesting a positive sign for the interaction term. Hypothesis 3b, on the other hand, predicted that the effects of *the CEO's stock option compensation* and *outside directors' stock option compensation* would be mutually substituting, suggesting a negative interaction term. The negative

and statistically significant ($p < 0.05$) relationship found in the interaction term of Model 4 supports this latter explanation, indicating a substitution effect between the incentives provided to the CEO and outside directors. Following the standard methodology (Cohen and Cohen, 1983), we also examined this relationship graphically and found further support for the substitution effect.

Robustness tests

To ensure the robustness of our results against alternative measures of risk used in the earlier literature, we ran additional regression tests with yearly *firm beta* and *capital expenditure per employee* as alternative dependent variables. The results of these robustness analyses were very similar to our main analysis. For both dependent variables we found a positive statistically significant effect for the *CEO's stock option compensation* and *directors' stock option compensation*, with the effect being significantly stronger for *directors' stock option compensation* ($p < 0.05$ for beta, $p < 0.001$ for capital expenditure per employee). For both dependent variables, we further found a negative effect for the interaction term of the two variables. Finally, to rule out a potential bias caused by multicollinearity resulting from the interaction terms, we followed the advice of Aiken and West (1991) and centered the independent predictor variables prior to computing the interaction terms. The results obtained from these models also produced results that were consistent with those reported in Table 2.

DISCUSSION

We set out to examine the independent and joint effects of stock option compensation schemes for CEOs and outside directors on firms' risk taking. As expected for both stock option compensation schemes, we find a positive effect on three measures of firm-level risk taking. Moreover, consistent with the assumption that the outside directors are better able to diversify their wealth than the CEO and are therefore less risk averse, we find that the effects of stock options on risk taking are much stronger for the outside directors than the CEO. Finally, we also find

that the interaction effect of the CEO's and outside directors' stock option compensation is negatively related to firm-level risk measures, suggesting a substitution effect between the two incentive schemes.

Contribution to theory

Our results provide a novel contribution to multiple agency theory, which has recently emerged to study situations that deviate from traditional one principal-one agent situations (Arthurs *et al.*, 2008; Hoskisson *et al.*, 2002). Prior literature in agency theory has predominantly examined compensation structures in bilateral agency situations and viewed outside directors mainly as an instrumental mechanism for monitoring, controlling, and giving strategic advice to the CEO. Our findings add to this literature. In particular, we add to a small substream that has focused on a two-agent model (e.g., Cyert *et al.*, 2002; Deutsch *et al.*, 2007) in which both CEOs and outside directors are seen to act as interrelated and yet self-motivated agents. Our findings suggest that theoretical models and managerial practice should take the different risk preferences of these agents into consideration.

Further developing multiple agency theory might be particularly important since multiple agency theory might be one way to reconcile traditional agency perspectives rooted in law and economics that focus on command and control with the emerging behavioral perspective of corporate governance (Hambrick, Werder, and Zajac, 2008; van Ees, Gabrielsson, and Huse, 2009) that emphasizes conflicts and bargaining emerging from different objectives and incentives held by the different parties on a board. Extending the principal agent model to multiple agents might provide a theoretical language to integrate economic arguments of incentive alignment into the behavioral and process accounts put forward by the behavioral perspective.

Showing that both CEO and outside director compensation simultaneously affect the level of firms' risk taking also contributes to prior corporate governance research on the role of outside directors in strategic decision making. This research has previously produced inconclusive or even contradictory results that have led some to question whether outside directors are an effective mechanism of corporate governance (e.g., Judge

and Dobbins, 1995). The results of this study suggest that one explanation of these mixed results could depend at least to some extent on the compensation scheme. When compensated appropriately, outside directors affect the overall risk level of the firm. The strong effects of outside director stock options on risk taking suggest that outside directors might play an important gatekeeper role in firms' risk taking.

Our results further support a substitution view of governance mechanisms (Rediker and Seth, 1995), in contrast to the mutually strengthening view (Hoskisson *et al.*, 2009). At low levels of CEO stock option compensation, a board that is compensated with stock options has a significant impact on increasing the overall risk level of the firm. This is consistent with research that argues that if the CEO is not given incentives for risk taking, then it is the board's task to ensure appropriate risk taking by monitoring management's decisions and getting involved in strategic decision making (Zajac and Westphal, 1994). At higher levels of CEO stock option compensation, the contribution made by the outside directors' stock option compensation decreases, and with very high levels of CEO stock option compensation, providing the board with stock option compensation starts to reduce the overall risk level, as if the board would start taking significant steps to constrain the firm from excessive risk taking. Thus, it would appear that providing stock option incentives for outside directors balances the effects of CEO stock options by flattening the curve.

Managerial implications

Our results have important implications for the structure of optimal compensation contracts. Given the magnitude of the effects of outside director compensation schemes, and the results regarding the substitution effect between CEO and outside director stock option compensation, optimal compensation contracts should take into consideration the potential interaction effects between these two groups of agents.

The practical challenge is assessing the appropriate target risk level and the recognition that not all risk taking is positive. A board can approve additional risk taking without recognizing that it represents a major strategic choice that can have significant implications for the company's future.

Detailed *ex post* case analyses of the scandals surrounding WorldCom and Enron, as well as numerous other firms, provide examples of what can happen when a board approves a relatively high risk level for the firm, but at the same time does not become sufficiently involved in the firm's activities to increase its monitoring efficiency to compensate for the risk.

A related challenge is the more fundamental question that in creating the possibility of higher returns, a high risk level almost invariably also increases the probability of failure. Whereas shareholders can easily reduce this risk by diversifying their portfolio, other stakeholders might not be able to do so. For instance, employees and local communities have significantly fewer opportunities to protect themselves against this downside risk. In addition, in firms that are family-controlled, the controlling family might have a large fraction of their wealth tied to the firm and might therefore be significantly more risk averse than the diversified shareholders typical of widely held corporations. This raises the question of board of directors' fiduciary duty, which should be toward the firm at large and not only individual shareholders. In this light, the question arises whether the compensation contracts for the CEO and outside directors should, in fact, be designed to reflect the interests of this broader group of stakeholders rather than the relatively narrow interests of diversified shareholders.

Limitations and future research

As in any study, our findings are limited in several ways that open up new avenues for research. Our study is limited to U.S. corporations that are often characterized by dispersed ownership by investors that are highly diversified and therefore risk neutral, as is often assumed in classical agency theory models. Ownership structures and the risk preferences of the owners of European or Asian firms might differ substantially from this setup. Furthermore, European or Asian firms face a different institutional environment for corporate governance practices that might lead to a different use of various governance mechanisms. This suggests that our findings might need to be replicated with samples of Asian and European firms. This would be particularly important in view of the recent findings according to which CEOs in different countries face systematically different degrees of

constraints on their action (Crossland and Hambrick, 2007). The relationship between the CEO and the board of directors is one of the key determinants of these differences.

Another limitation concerns our measures. Measures for risk taking have long been disputed in the strategy literature (e.g., Bromiley, 1991; Devvers *et al.*, 2008; Miller and Bromiley, 1990; Ruefli *et al.*, 1999). Although we tested the robustness of our results with several alternative measures and found similar results, our main measure, *book equity to market equity* is an overall firm-level risk measure derived from the finance literature and relies on assumptions about capital market efficiency. Future studies could complement our study by utilizing more fine-grained measures of risk taking as, for instance, proposed by Devvers and colleagues (2008). A possible extension of such research could be to test path models in which corporate governance variables predict risky firm actions that, in return, predict overall firm risk (see for instance, Larraza-Kintana *et al.*, 2007).

Future research could also make a more finely-grained distinction between different types of owners, including different institutional blockholders, private equity firms, family ownership, and public ownership, and the owners' influence on firms' risk taking through the design of outside director and CEO incentive schemes. The paper by Hoskisson *et al.* (2002) shows one potential way in which this could be done.

Beyond addressing the limitations of our study, we believe that several extensions to our research would be worthwhile. Future research could also extend our study to additional antecedents of board risk taking. Such additional antecedents would help us understand under what conditions boards are effective decision makers and, more broadly, how corporate governance mechanisms should be structured to bring them in line with the ultimate goals of shareholders. Future studies could also open up the board tasks through which outside directors can affect risk taking. Different types of compensation might lead to differences in the type of board tasks outside directors engage in.

Another potential future extension would be to examine the role of boards' compensation committees in setting the CEO's compensation (e.g., Belliveau, O'Reilly, and Wade, 1996; Conyon and Peck, 1998; Daily *et al.*, 1998). Since it is commonly the board's compensation committee that

sets the CEO's bonus plans and allocates stock options, it would be interesting to examine how the social comparisons between the outside directors' compensation and the CEO's compensation affect each other. While earlier research has found that social comparisons play a role across firms (Ezzamel and Watson, 1998), do they also play a role when the compensation committee is deciding on CEO stock options?

CONCLUSIONS

As a whole, our paper opens up a broad range of interesting research questions regarding the antecedents and consequences of board and CEO compensation and how these two jointly interact and produce a number of different externally observable phenomena. We hope that our paper advances the existing research one step further to a deeper understanding of how incentives at the top convert into firm-level behaviors.

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