

Does the Overconfidence of the CEO Affect His Pay Structure?

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Abstract If board of directors know the overconfidence level of their Chief Executive Officers, the CEOs' compensation should reflect the optimal structure which aligns the CEOs' incentives with shareholders' interests. Previous literature has documented the existence of overconfident CEOs and the effect of the overconfidence on the decisions of the firm. Since overconfidence can be misconstrued as talent, however, boards may not easily recognize CEO overconfidence. Even if overconfidence is recognized, boards may not give optimal contract due to CEO entrenchment. Consistent with the theory, I find that boards do optimally set CEO compensation structure consisting of low equity to cash mix for slightly overconfident CEOs.

Keywords: CEO Overconfidence compensation boards

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1. Introduction

One of the important goals of structuring compensation for executives is mitigating agency costs. Firms want CEOs to take actions that will maximize firm value. CEOs, on the other hand, may want to engage in empire building or other myopic actions that hurt shareholder value. Therefore, setting optimal compensation structures is a vital objective for aligning shareholder interests with those of their CEOs. While the nature of the industry and the specific concerns of a firm play a major role in setting compensation structure, the characteristics of the executive should also influence his pay. For example, the innate propensity of a CEO to take risks will affect the projects the CEO chooses to undertake. Unchecked, this propensity can harm the firm. Compensation is one mechanism that can alter CEO's behavior, and thereby affecting firm value. To set optimal compensation, the firm must understand CEOs innate characteristics. This paper studies one particular characteristic, the overconfidence level, of the CEO and whether firms adjust the CEO's compensation accordingly.

Overconfidence is defined as the degree of precision in one's knowledge or the perception of increased personal ability to control outcomes. Applied to CEOs, overconfidence translates to underestimating the true risk of projects and overestimating the expected outcome of projects. Literature in psychology has shown via experiments that individuals are usually overconfident. In order to reach the pinnacle position, CEOs have had success with numerous actions that initially contained uncertain outcomes; actions that others less overconfident may not have taken. The success of those actions may further solidify CEO's perception of his own abilities. Therefore, CEOs on average are overconfident. Goel and

Thakor [10] build a theoretical framework that motivates the reason why the position of CEO may be filled by a pool of overconfident candidates.

Empirical evidence of overconfident CEOs and managers has been documented in finance papers. Roll initiates the overconfidence literature in finance by using managers' hubris to explain merger activities. Building on the psychology literature that shows men are more overconfident than women, Barber and Odean [3] find that men trade stocks more often than women and that the excessive trading reduces the men's net returns. Malmendier and Tate [18] show that firms with overconfident CEOs have higher sensitivities to cash flow. In their follow up paper, Malmendier and Tate [19] argue that overconfident CEOs make poorer acquisitions. The survey paper by Ben-David, Graham and Harvey [5] find that overconfident CFOs use lower discount rates, conduct more mergers, and have more long-term debt than CFOs who are not overconfident.

Within the empirical literature on overconfidence, no paper discusses whether boards recognize the CEOs' overconfidence levels and whether the boards compensate the CEOs accordingly. This paper tackles these issues. The theory paper by Goel and Thakor [10] shows that the level of CEO overconfidence has a non-monotonic relationship to firm value. Since the CEOs make the ultimate decisions on project choices, and the project choices directly affect the firm values, knowing the overconfidence level of the CEO is the first step to maximizing firm value. Recognizing overconfidence and the degree of overconfidence, however, are not trivial. Ludwig and Nafziger [15] point out that people view themselves as not being overconfident. Applying that finding to managers, a CEO may assert that he possesses superior talent rather than experiences luck. As such, the board must evaluate the CEO's overconfidence on its own. While that task is imprecise, Malmendier and

Tate [19] suggest that shareholders recognize when the CEO is overconfident by showing that shareholders sell acquiring firms' stock when overconfident CEOs announce acquisitions. If shareholders in aggregate can perceive CEO overconfidence, boards should as well, particularly given that boards would have closer interactions with their CEOs and be able to better evaluate them. I find support that boards are aware of the overconfidence level of their CEOs.

If a board recognizes the overconfidence level of its CEO, the board can then offer a compensation mix that takes into account the CEO's overconfidence level. Misalignment of CEO incentives to shareholder interest can cause suboptimal actions of the CEO. Gervais, Heaton and Odean [9] and De la Rosa [8] show that overconfident CEOs can be compensated optimally to maximize shareholder value; slightly overconfident CEOs should be compensated with less equity/cash than rational CEOs whereas extremely overconfident CEOs should be compensated with more equity/cash mix. My paper tests whether CEOs are compensated for their overconfidence. I find evidence suggesting that boards do consider the CEOs' overconfidence level when setting the CEOs' compensation mix.

The rest of the paper is organized as follows. Section 2 motivates why CEOs of all overconfidence levels may be desired depending on the specifics of each firm's needs. Section 2 also discusses the effects of compensation on firm value and develops the hypotheses. Data and methodology follow in section 3. Section 4 analyzes the compensation mix for potentially distressed firms or high growth firms. Robustness checks are discussed in section 5. Section 6 concludes.

2. Development of the Hypotheses

According to Goel and Thakor [10], the overconfidence level of CEOs can affect firm value non-monotonically. Slightly overconfident CEOs can increase firm value while extremely overconfident CEOs will decrease firm value. Figure 1A shows an example of how overconfidence affects firm value absent any compensation adjustments. The point R indicates the firm value for a rational CEO (i.e. a CEO with zero overconfidence).

A rational, risk averse CEO will underinvest because the CEO receives higher utility from continuing with current projects with known payoffs than from investing in positive NPV projects with the possibility of negative outcomes. An overconfident CEO believes he has higher skills or is more able to affect the outcome of projects than in reality. His belief positively biases his NPV assessment and leads him to accept more projects than the rational CEO. For the same level of risk aversion, the slightly overconfident CEO would less likely avoid the positive NPV projects due to the project's risk level than the rational CEO would. The actions of the slightly overconfident CEO are more aligned with the shareholders' interests, which leads to an increase in firm value. For these CEOs, their overconfidence offsets their risk aversion to some degree. As the overconfidence level increases, the NPV threshold decreases. At the optimal level of overconfidence, C^{opt} , the CEO accepts all positive NPV projects. As overconfidence level increases beyond

C^{opt} , the firm value decreases monotonically. A CEO with overconfidence of C^* has taken on negative NPV projects such that the firm value is the same as that under a rational CEO.

Compensation can be used to align CEOs' actions with shareholders' interests. Classical agency theory posits that rational, risk averse CEOs should be compensated with more equity (Holmstrom, 1982 and Jensen and Murphy, 1990). More equity compensation incentivizes risk averse CEOs to undertake positive NPV projects they would not have otherwise accepted. The increased firm value from compensating a rational CEO (zero overconfidence) with more equity is denoted as R' on Figure 1B. In Figure 1B, the firm value from Figure 1A is overlaid for illustration purposes of the critical points. Gervais, Heaton, and Odean [9] show that compensation can also be used to better align overconfident CEOs' actions with shareholder interests. Since the slightly overconfident CEO is already taking on the marginally positive NPV projects, he does not require as much equity compensation as the rational CEO. If a slightly overconfident CEO is offered the same compensation mix as a rational CEO, for example, the slightly overconfident CEO may lower the threshold of NPV projects to undertake such that negative NPV projects are accepted.

As depicted in Figure 1B, the cutoff point of overconfidence, C^{*1} in which the firm value is the same as for the rational CEO has moved to the left from C^* due to the increase in firm value for rational CEOs with optimal compensation. Although there's an optimal point of overconfidence for each firm that maximizes firm value, setting a goal of hiring a CEO with overconfidence level of $[0, C^{*1}]$ seems reasonable since overconfidence levels cannot be readily and accurately detected. The shift from C^* to C^{*1} gives the firm potentially fewer overconfident managers to select to fill the CEO position when optimal compensation is offered than when no adjustment to compensation is done.

A CEO with a very high level of overconfidence will pursue extremely risky projects regardless of his compensation. C^{*2} depicts the point at which the optimal compensation mix changes. Although a low equity/cash compensation mix may increase the NPV threshold, the compensation cost savings from offering high equity mix to the extremely overconfident CEO could more than offset the marginal increase in firm value from the increase in NPV threshold. The firm knows the true expected payoffs and risks of the projects. The actual cost of equity compensation may be much lower than the CEO's perception of the equity value. Therefore, the net firm value can increase slightly by offering high equity mix. The group of CEOs in which the high equity mix works to maximize firm value is dubbed extremely overconfident. As shown in Figure 1B, compensation can be used to increase firm value for any level of overconfidence.¹

¹ Although Figure 1 shows that a slightly overconfident CEO increases firm value compared to a rational CEO, he does not necessarily do so. Goel and Thakor [10] show that overconfident CEOs underinvest in information. To the extent that the investment in information is critical, a rational CEO is preferred. For these firms, any overconfidence may deteriorate firm value.

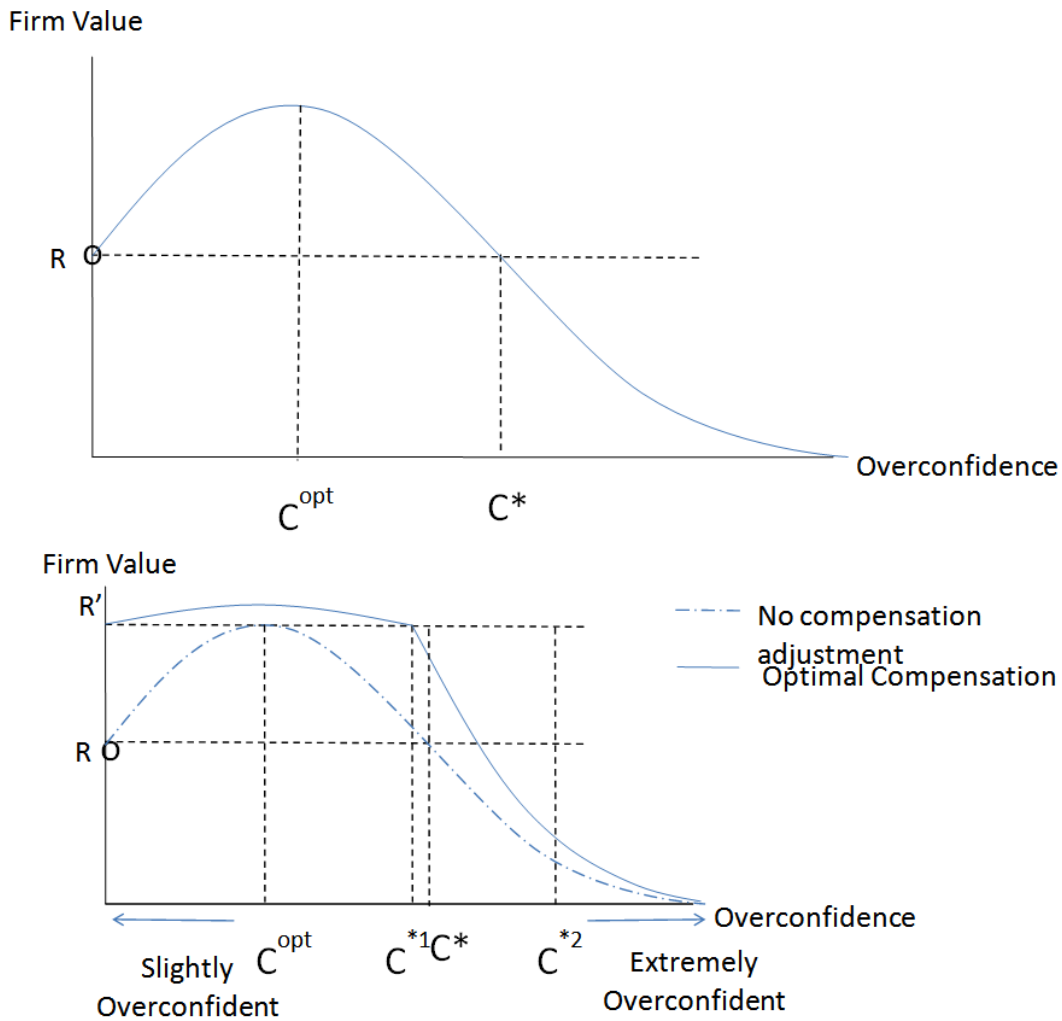


Figure 1. A: Effect of overconfidence on firm value for risk averse CEOs without compensation adjustments, B: Effect of overconfidence on firm value for risk averse CEOs with and without out offsetting compensation adjustments

The cutoff points C^* and C^{*1} in Figure 1B change depending on the nature of the firm. Goel and Thakor [10] show that firms in high growth markets may benefit from having CEOs with very high levels of overconfidence. Gervais, Heaton, and Odean [9] add that firms with extremely high upside potential will benefit from having CEOs with higher overconfidence levels. For these firms, points C^* and C^{*1} move to the right. However, while C^* differs across industries and across the life cycle of the firm, most boards will want to hire either a rational or slightly overconfident CEO ex-ante². The potential exceptions include start-up firms or firms near bankruptcy. These firms have very small downside risk. Therefore, even though extremely overconfident CEOs will lower the expected value of the firm, the firm may choose to take that gamble.

For ease of analysis, I assume there are three discrete types of CEOs from which firms may select: rational, slightly overconfident, and extremely overconfident. In Figure 1B, the area between C^{*1} and C^{*2} has optimal compensation similar to that of slightly overconfident, and will be treated as such for the main analysis. Gervais, Heaton, and Odean [9] show that in industries where multiple firms desire one CEO, optimal compensation leads to higher cash and higher equity compensation, but

the ratio of equity to cash remains constant. Therefore, I will use equity/cash as my benchmark for comparing CEOs of differing overconfidence levels. For illustration purposes, I assume that a firm has a choice of making one of the following three offers. Offer 1 is the baseline for a risk averse, rational CEO. As discussed above, less equity is required when the CEO is slightly overconfident (offer 2), and more equity is optimal when the CEO is extremely overconfident (offer 3.)

	Offer 1	Offer 2	Offer 3
Descriptive	Firm's first best offer for rational, risk averse CEO	Firm's first best offer for slightly overconfident, risk averse CEO	Firm's first best offer for extremely overconfident, risk averse CEO
Cash (cash and bonus)	50	60	40
Equity value (Options and Restricted stock)	50	35	55
Total	100	95	95
Equity/cash	Baseline	low	High

In the Table above, I purposely set offer 2 and offer 3 to have lower total compensation than that of offer 1. I assume that the board has complete control to set compensation to maximize shareholder value. This assumption will be relaxed later in this section. The total for offer 2 is designed to be less than offer 1 to show that the firm can take advantage of the CEO's risk aversion. A

² One firm's view of extremely overconfident CEO may be another firm's optimal overconfident CEO.

risk averse CEO receives higher utility from offer 2 than offer 1 since he prefers the certainty of cash now over the risky equity that may take up to ten years to vest even though offer 2 has lower total compensation value. Offer 3 takes advantage of an extremely overconfident CEO in that he will overvalue the equity compensation and believes he's compensated with higher total compensation than in reality. Because of this overvaluation, Offer 3 requires less cash compensation than for the rational CEO.

Unless firms are very high growth or are near bankruptcy where the potential upside is extremely valuable, boards will not want to hire extremely overconfident CEOs ex-ante. Firms with high market to book are considered high growth firms, whereas firms with low market to book may be distressed firms. Therefore, I limit my sample to firms with market to book values in the inner-quartiles market to book per year and considers these firms value firms. These firms will want to hire either rational or slightly overconfident CEOs ex-ante. Focusing on these firms allows for a clear test of whether firms compensate for the CEO's overconfidence.

H1: Slightly overconfident CEOs should have a lower compensation mix (equity/cash) than rational CEOs if the firms recognize the CEOs' overconfidence attribute.

In theory, the board decides the CEO compensation. However, a board that knows the characteristics of its CEO may not be able to set the optimal pay structure if the CEO is entrenched. Bebchuk, Fried, and Walker [4] posit that CEOs do not have an arm's length dealing with the board of directors. This leads to CEOs determining their own pay subject to the "outrage" constraint. The Sarbanes-Oxley act of 2002 requires all firms to have a majority of independent board members. Chhaochharia and Grinstein [7] show that firms that were more affected by this regulation decreased CEO compensation significantly subsequent to the passage of the regulation. These results find support for CEOs' ability to control their own compensation when the board is weak. I now relax the previous assumption that boards have total control over compensation. I consider the equilibrium relative equity/cash mix for the three states of overconfidence by considering board strength, board's first best offer, and CEO's preference. The board will want to maximize firm value. The risk averse CEO will want more cash. The strength of the board determines which offer is the equilibrium if the board's first best offer differs from the CEO's preference. The following Table arrives at the expected equilibrium of relative equity/cash when negotiation between the firm and the CEO takes place.

CEO attributes	Board strength	Board st best offer	CEO 1 st best option	Equilibrium	Relative Equity/cash
Rational	Strong	Offer 1	Offer 2	Offer 1	Baselin
Rational	Weak	Offer 1	Offer 2	Offer 2	Low
Slightly overconfident	Doesn't matter	Offer 2	Offer 2	Offer 2	Low
Extremely overconfident	Strong	Offer 3	Unclear	Offer 3	High
Extremely overconfident	Weak	Offer 3	Unclear	Unclear	Unclear

If the CEO is rational, the optimal compensation leads to the board making offer 1. If the board is strong, offer 1 (baseline equity/cash) is the equilibrium. If the board is weak, the CEO's preference wins and the CEO will be able to earn offer 2 (low equity/cash). If the CEO is

slightly overconfident, the board's first best is the same as CEO's preference. The optimal compensation consists of lower equity/cash ratio. If the CEO is extremely overconfident, he mistakenly views the equity compensation as having higher value than in reality. Therefore, he is more willing to take higher equity compensation. However, since he is still risk averse, the CEO's preference is unclear. If the board is strong, offer 3 will be the equilibrium offer if the CEO is extremely overconfident. If the board is weak, the compensation mix of the CEO is unclear.

H2: Slightly overconfident CEOs should have a lower compensation mix (equity/cash) than rational CEOs when the board strength is strong.

The above hypotheses assume that the boards can identify the overconfidence level of the CEO. Recognizing overconfidence, however, may be difficult. By definition, CEOs do not believe they are overconfident. They believe they know the true risks of the firm and the true risks of their projects. Therefore, CEOs would not be able to express their overconfidence levels to the boards. Additionally, Ludwig and Nafziger [15] show that people believe others are unbiased. Since CEOs may have been promoted due to low risk aversion and selecting optimal projects or promoted due to overconfidence and good luck, the confounding signals may limit the board's ability to determine the CEO's overconfidence level. The alternative hypothesis is that if the board does not recognize the CEO's overconfidence level, the compensation mix for overconfident CEOs and rational CEOs would not be statistically different.³

Following Goel and Thakor [10] and Gervais, Heaton, and Odean [9], I assume that CEOs are risk averse. A risk-neutral or risk-loving, rational CEO does not need to be compensated with equity. He will choose all positive NPV projects. The difference between risk-loving and overconfidence is that risk-loving CEOs understand the true risk of the projects whereas overconfident CEOs believe they can improve the projects' NPVs. For risk neutral or risk loving CEOs, any overconfidence will deteriorate firm value. Ex-ante, firms would prefer to hire risk averse, slightly overconfident CEOs than risk-loving rational CEOs. Firms would be able to pay risk-averse, slightly overconfident CEOs less in total compensation to take advantage of the CEO's risk aversion. According to Goel and Thakor [10], the CEO wants to reveal his risk aversion in order to receive the preferred compensation. Overconfidence, however, cannot be revealed since the CEO is unaware of his own overconfidence. Given that the firms can know CEO's risk aversion prior to the appointment and that firms prefer to hire risk averse CEOs, it's likely that the CEOs are risk averse.

3. Data and Methodology

I use Execucomp data for all CEO compensation data. I delete CEOs who have less than 5 years of tenure. This requirement stems from the use of exercisability of stock options as proxy for overconfidence. Following

³ A lack of statistically significant relationship between overconfident and rational CEO's compensation mix could also result from the Boards' lack of appreciation for the implications of overconfidence even though they do observe the CEO's overconfidence level.

Malmedier and Tate [18,19], I restrict my sample to only CEOs that could have been overconfident. This restriction allows for a better matching of firms and limits measurement error. Overconfidence measure takes on the value of one if the CEO does not exercise his options when the stock price increases by 67% within five years, zero otherwise. Therefore, the sample would exclude CEOs that are overconfident but deemed rational due to poor firm performance. Using CRSP data to determine the stock price appreciation, I delete firms whose stock price did not increase at least 67% in the 5th year after option grant date. I also delete firm-years with comments in

Execucomp as this usually indicates a change in fiscal year, or other anomalies that could unintentionally change the mix of compensation. I then restrict my sample to those in the inner quartiles of market to book to capture firms that are not start-ups or near bankruptcy. Table 1 shows the progression of the number of observations per year through the different filters. My end sample results in 3,307 observations from 736 unique firms and 782 unique CEOs-firms. This table shows that my sample is not particularly concentrated in any year and that overconfident CEOs are not concentrated in any year.

Table 1. Summary Statistics show the progression of number of firms per year used in the analysis. Column (1) shows the total number of firms in the Execucomp database. Column (2) filters out the firms whose CEOs were in office for less than 5 years, firms with stock price that did not increase at least 67% from the time of first stock options grant, firms that had comments in the comment field in Execucomp and firms where the CEO received less than \$1000 in salary and bonus. Column (3) shows the number of firms after eliminating the top and bottom Market-to-book quartiles and deleting all observations with missing fields for variables: mix, noiseROA, NoExer5, age, FCF, leverage, PCTShareOwn, and MB. Column (4) shows the number of observations where the CEO is considered overconfident by not exercising options in the first 5 years after grant when stock prices rose above their cutoffs. Columns 1 and 2 show the progression of data limitations. Columns 3 and 4 show data processing results

Year	(1) Number of firms in Execucomp	(2) Firms with stock price over cutoff	(3) Value Firms	(4) Slightly Overconfident CEOs
1992	433	66	12	3
1993	1157	221	98	19
1994	1550	341	155	27
1995	1600	411	187	33
1996	1651	459	212	42
1997	1674	521	237	53
1998	1731	540	243	49
1999	1811	571	254	47
2000	1792	588	257	48
2001	1671	611	282	50
2002	1675	629	295	52
2003	1692	604	279	49
2004	1699	578	271	49
2005	1699	492	228	41
2006	1646	411	190	30
2007	935	220	107	21
Total observations	24416	7263	3307	613
Total # of unique firms	2872	920	736	135
Total # of unique Firm/CEOs	5417	989	782	137

Table 2. Summary statistics for all CEO compensation in Execucomp for 1992-2007 and for the inner Market-to-book quartile which represent the firms that would hire either rational or slightly overconfident CEOs

		Execucomp Population	Inner Market to book quartiles sample
Salary	mean	629.02	680.21
	Std. Dev	356.30	350.18
	Obs	24,416	3,621
Bonus	mean	674.86	804.28
	Std. Dev	1,621.58	1,605.75
	Obs	24,416	3,621
Shares Owned excluding Options	mean	2,559.36	3,268.36
	Std. Dev	25,137.41	32,409.75
	Obs	23,320	3,528
Option Awards Fair value	mean	1,544.61	1,569.76
	Std. Dev	3,531.09	2,486.08
	Obs	2,297	278
Stock Awards Fair value	mean	2,879.75	2,053.47
	Std. Dev	46,920.06	3,540.09
	Obs	2,297	278
Option Awards Black-Scholes Value	mean	2,191.94	2,440.87
	Std. Dev	8,842.26	8,603.95
	Obs	21,906	3,331
Restricted Stock grant	mean	468.99	634.04
	Std. Dev	4,792.86	11,399.43
	Obs	22,118	3,343
Age	mean	55.62	55.36
	Std. Dev	7.59	6.98
	Obs	22,774	3,523

Table 2 shows the summary statistics for the universe of Execucomp data from 1992-2007 and the filtered dataset. The filtered dataset does not appear to be significantly different than the universe of Execucomp data. Option awards fair value, calculated by the firm per FAS 123R regulation, replaces option awards Black-Scholes value calculated by Execucomp after 2006.

Similarly, stock awards fair value replaces restricted stock option. The intent of FAS 123R is to give a more accurate assessment of compensation costs. Comparing the earlier assessment using Black Scholes value and restricted stock grant to their later counter-parts of option and stock awards fair value supports the finding that firms are shifting from option grants to restricted stock grants.

Table 3. The univariate statistics show mean values for the total sample as well as the average values broken down by whether the CEO is overconfident. An overconfident CEO is defined as one who does not exercise his options within the first five years even when the stock price is over the cutoff. * represents 10% significance, ** represents 5% significance and * represents 1% significance difference in the mean**

Variable	Units	Mean	Overconfident	Not Overconfident	Difference in mean	T-stat
equity	Thousands	3,151.38	2,234.99	3,359.90	1.74	*
cash	Thousands	1,465.34	1,423.37	1,474.89	0.65	
equity/cash	ratio	2.70	1.56	2.96	1.51	
MB	ratio	1.42	1.40	1.42	0.54	
NoiseROA	ratio	0.42	0.05	0.50	0.93	
NoExer5	binary	0.19	1.00	0.00		
AGE	years	55.21	55.68	55.10	-1.85	*
FCF	ratio	0.10	0.10	0.10	-0.53	
leverage	ratio	0.78	0.05	0.76	-1.85	*
PCTShareOwn	ratio	0.03	0.46	0.02	-7.36	***
CRSP Market Cap	Millions	5,665.42	4,073.71	6,027.60	2.34	**
Total Compensation	Thousands	5,034.03	4,076.14	5,252.00	1.75	*
Stock Wealth	Millions	97.55	181.09	78.54	-3.68	***
Nobs		3307	613	2694		

Table 3 shows the univariate statistics for the variables of interest used in the main regression. Cash is defined as salary plus bonus; equity is the sum of restricted stocks and stock options; mix=equity/cash. The relative noise of accounting measures, the CEO's age, the firm's free Cash flow, the firm's leverage, and the percent shares owned by the CEO have been argued to theoretically affect compensation mix.

Table 3 also breaks the sample down into overconfident and non-overconfident CEOs. Following Malmendier and Tate [18,19], I define overconfident CEOs as those who do not exercise their first option grants when the options are more than 67% in the money more than once in the five year period. Equity compensation for overconfident CEOs is significantly less than for overconfident CEOs at the 10% level, consistent with hypothesis 1. A rational CEO requires more equity compensation to induce the CEO to take more positive NPV projects than he otherwise would. An overconfident CEO requires less equity since his overconfidence offsets his risk aversion to some degree.

Although the percentage of ownership is significantly higher for the overconfident CEOs, the corresponding firm sizes are smaller. The product of these two variables shows that the overconfident CEOs have significantly higher stock wealth at the 1% level. Stock wealth is defined as the percentage of ownership multiplied by the market cap of the firm at fiscal year-end. The higher stock wealth in conjunction with lower total compensation implies that an overconfident CEO may have a higher percentage of personal wealth tied up in the firm. Hall and Murphy [12] show that a higher percentage of personal wealth tied up in the firm's stocks decreases the CEO's perceived value of the options. A lower CEO perceived value requires higher equity compensation for the same level of incentives, ceteris paribus. Therefore, I include the CEO's stock wealth in all the regressions to control for the potential that increased personal wealth in the firm can result in an increase of the CEO's equity compensation and thereby increasing his compensation mix.

Bryan, Hwang, and Lilien [6] and Yermack empirically show mixed results for the significance of the variables that should theoretically affect equity/cash mix. I include these control variables in the regressions. Table 4 shows the main result for testing hypothesis 1.

$$\frac{EquityComp}{CashComp} = \beta_0 + \beta_1 * noiseROE + \beta_2 * age + \beta_3 * FCF + \beta_4 * leverage + \beta_5 * PctSharesOwned + \beta_6 * \frac{Market}{Book} + \beta_7 * StockWealth + \beta_8 * NoExer5 \quad (1)$$

Following Lambert and Larcker and Yermack, I use the variance of firm's ROE scaled by variance of its stock price as the measure of accounting noise, noiseROE. The higher the accounting noise, the less the information is impounded into the accounting measure. Therefore, less compensation should be dependent on that measure. Since cash compensation is mostly a function of accounting measures, more compensation should be in the form of equity. Therefore, β_1 is expected to be positive. The variance of ROE and the variance of stock price per firm are calculated from available annual data starting fifteen years before the CEO start year to the end of CEO tenure.

As CEOs age, they may become more risk averse. Projects with long horizons are overlooked for short-term gains at the expense of the shareholders. Thus, more equity is required to incentivize the CEOs close to retirement to select projects best for the firm. Consequently, the older the CEO, the higher the optimal equity/cash mix. β_2 is expected to be positive.

When the firm's free cash flow is low, the firm may be unable to compensate the CEO with cash. Therefore, a firm with less free cash flow is expected to compensate its CEO with higher equity/cash mix. β_3 is expected to be negative. High firm leverage is expected to have a monitoring effect on the CEO. Therefore, the higher the leverage, the less the required equity pay. β_4 is expected to be negative. With higher CEO ownership, the CEO's

incentives are more aligned with shareholder value. Therefore, a CEO's percentage ownership of its firm is negatively related to optimal equity pay. β_5 is expected to be negative. The market to book value of the firm signifies the growth and investment opportunities of the firm. Growth firms want CEOs to take on more risks, and thus

compensate the CEO with more equity than value firms. Additionally, firms with high investment opportunities may require more information. These firms would want to incentivize their CEOs through more equity compensation to induce their CEOs to exert effort in information gathering. Therefore, β_6 is expected to be positive.

Table 4. Regression parameters for: $\frac{EquityComp}{CashComp} = \beta_0 + \beta_1 * noiseROE + \beta_2 * age + \beta_3 * FCF + \beta_4 * leverage + \beta_5 * PctSharesOwned + \beta_6 * \frac{Market}{Book} + \beta_7 * StockWealth + \beta_8 * NoExer5$

	Expected Sign	Coefficient
Intercept	+	4.59** (1.78)
NoiseROE	+	0.00 (0.00)
NoExer5	-	-1.27*** (0.44)
AGE	+	-0.02 (0.04)
FCF	-	-5.55** (2.56)
leverage	-	-0.17 (0.15)
PCTShareOwn	-	-6.05 (3.17)
MB	+	0.08 (0.44)
StockWealth	+	0.00** (0.00)
Nobs		3307

Overconfidence takes on the value of 1 if the CEO does not exercise his options even though the firm stock price increased by 67% within 5 years of grant. Overconfidence equals zero otherwise. The regression is the result of double clustering the standard errors on firm and year. The statistical significance is represented by *** (1%), ** (5%), * (10%).

Table 4 shows the results of the regression with double clustering of standard errors on firm and year.⁴ All of the variables follow the expected sign with the exception of age. However, the negative coefficient on age is not significant. After controlling for variables that can affect equity/cash mix, the overconfident measure, NoExer5, shows a significant negative relationship to the compensation mix at the 5% level. This result supports hypothesis 1. CEOs that are overconfident are paid less in equity mix, which corroborates with the notion that boards are aware that their CEOs are overconfident. If boards are not aware or not concerned about the CEOs' overconfidence attribute, the parameter estimate for NoExer5 regardless of sign would not be significant, or insignificantly different from zero. The probability that NoExer5 is zero is 1.1%. Therefore, I rejected the notion that boards are not aware or are not concerned about the overconfidence attribute of their CEOs at the 5% level. The one tail test for NoExer5 being positive has a p-value of 0.55%. Thus, I reject that NoExer5 is positive. This result shows that boards do pay overconfident CEOs less in equity/cash than do boards of rational CEOs, consistent with the theory that overconfidence partially offsets risk aversion and that firms compensate in accordance with firm value maximizing goals.

Using board independence as a proxy for strong boards, I argue that strong boards will set pay optimally for their CEOs. I use the available IRRC data from 1996-2004. I define board independence as boards with at least 50% of members not affiliated with or employees of the firm. Table 5 shows the data limitations from linking my

sample with those from IRRC. Consistent with the results of Chhaochharia and Grinstein [7], my sample shows that board independence increases over time. Similar to table 1, Table 5 shows that overconfidence is not clustered around a particular year.

Table 6 shows that the double clustering regression results do not qualitatively change with this smaller subsample. Most of the variables show a drop in significance. The drop in the number of observations from 3307 to 1883 and the drop in the number of unique firms from 736 to 539 could have contributed to this result. The variable of interest, NoExer5, is less significant at the 10% level. To the extent that this subsample has systematic differences from the main sample, the results for testing H2 may not extend to the whole sample.

To test H2, I break the subsample into independent and non-independent boards. The regressions for both are show in Table 7. For the independent board, the sign for NoExer5 remains negative. Although the magnitude is smaller than that of the subsample, the standard error decreases considerably. The probability that NoExer5 is positive is 0.56%. Therefore, I reject that NoExer5 is positive when boards are strong. For the dependent board, the magnitude for NoExer5 is quite large, but is insignificantly different from zero. This result is consistent with H2. Strong boards have a better control of CEO compensation mix, and are able to compensate overconfident CEOs with less equity. Non-independent boards as a group do not appear to have as much control.⁵

The potential for endogeneity exists. One can argue that the measure for overconfidence may capture the effect of

⁴ Double clustering code is developed by Ian Drummond Gow, Gaizka Ormazabal and Daniel Taylor

⁵ This result could also be due to the smaller sample size for the non-independent board.

CEO wealth. A CEO is considered overconfident if he does not exercise his options within 5 years. However, it may be the case that the CEO chooses not to exercise because the option is only a small portion of his total wealth. As Hall and Murphy [12] point out, the total wealth of the CEO affects the value of the options to the CEO. A CEO's wealth is inversely related to his utility of options divided by his utility of cash. The wealthier the CEO, the less value he receives from equity compared to cash. Two identical, rational CEOs may choose to exercise at different thresholds if their initial wealth differs. The

CEO with higher initial wealth will require a higher threshold to exercise. Therefore, the overconfidence measure may be picking up a wealth measure. However, the wealthier the CEO, the less the option is worth to the CEO. Therefore, to align the incentives of the CEO with the shareholders interest, ceteris paribus, the wealthier CEO should be offered more equity than a less wealthy CEO should. This reasoning would result in a positive relationship between equity/cash mix and the overconfidence measure, opposite of the empirical results.

Table 5. This table shows progression of sample size for the inclusion of board director data. Column (1) shows all available board data by year. Column (2) shows the number of independent boards per year where independence is defined as firms who have 50% or more of directors not affiliated or employees of the firm. Column (3) shows the subset of independent boards with overconfident CEOs. Columns (4) and (5) show the number of observations and unique firms for dependent boards and dependent boards with overconfident CEOs respectively

	(1)	(2)	(3)	(4)	(5)
year	Available board data	Independent Boards	Overconfident CEOs with independent boards	Dependent Boards	Overconfident CEOs with dependent boards
1996	141	107	15	34	8
1997	181	140	32	41	10
1998	187	145	28	42	12
1999	196	155	33	41	7
2000	204	165	32	39	6
2001	234	184	32	50	8
2002	257	218	37	39	10
2003	244	217	40	27	6
2004	239	226	39	13	3
Total	1883	1557	288	326	70
Total # of unique firms	539	490	92	141	30
Total # of unique Firm/CEOs	569	519	93	142	30

Table 6. The dependent variable is the ratio of equity compensation to cash compensation. Regression results for the subsample that has board director data from IRRIC from 1996-2004. Regression parameters for:

$$\frac{EquityComp}{CashComp} = \beta_0 + \beta_1 * noiseROE + \beta_2 * age + \beta_3 * FCF + \beta_4 * leverage + \beta_5 * PctSharesOwned + \beta_6 * \frac{Market}{Book} + \beta_7 * StockWealth + \beta_8 * NoExer5$$

	Expected Sign	
Intercept	+	5.23 (3.43)
NoiseROE	+	0.00 (0.00)
NoExer5	-	-1.44* (0.68)
AGE	+	0.00 (0.99)
FCF	-	-7.46 (0.22)
leverage	-	-0.27 (0.20)
PCTShareOwn	-	-8.90* (4.53)
MB	+	-0.53 (0.98)
StockWealth	+	0.00** (0.00)
Nobs		1883

NoExer5 (Overconfidence measure) takes on the value of 1 if the CEO does not exercise his options even though the firm stock price increased by 67% within 5 years of grant. Overconfidence equals zero otherwise. The regression is the result of double clustering the standard errors on firm and year. The regression is the result of double clustering the standard errors on firm and year. The statistical significance is represented by *** (1%), ** (5%), * (10%).

One can argue that low equity/cash mix causes overconfidence as measured by NoExer5. A CEO offered a lower percentage of compensation in equity may not be as vigilant about stock price as a CEO whose compensation consists mostly of equity. In the extreme, a CEO with 1% of compensation in options may not be as attentive to exercising his options as a CEO with 99% of compensation in options. This concern is somewhat

mitigated by the fact that the mean equity/cash mix is 1.56 for overconfident CEOs and 2.95 for the rational CEOs (Table 3). On average, both groups are paid millions of dollars in equity and should therefore be attentive to their stock values and diversifying the idiosyncratic risks of the firm by exercising his options. To be more thorough, however, I should find an instrumental variable that is correlated with overconfidence but not the compensation mix.

Table 7. The dependent variable is the ratio of equity compensation to cash compensation. Regression results for the subsample that has board director data from IRRC from 1996-2004 further divided into independent boards or non-independent boards. Independent boards are defined as firms with 50% or more directors that are not affiliated with or employees of the firm. The regressions are the result of double

clustering the standard errors on firm and year. The statistical significance is represented by * (1%), ** (5%), * (10%).** $\frac{EquityComp}{CashComp} = \beta_0$

$$+ \beta_1 * noiseROE + \beta_2 * age + \beta_3 * FCF + \beta_4 * leverage + \beta_5 * PctSharesOwned + \beta_6 * \frac{Market}{Book} + \beta_7 * StockWealth + \beta_8 * NoExer5$$

Independent Boards:		
	Expected Sign	
Intercept	+	9.29*** (1.98)
NoiseROE	+	0.00 (0.00)
NoExer5	-	-0.62*** (0.19)
AGE	+	-0.13*** (0.03)
FCF	-	-2.85** (0.96)
leverage	-	-0.02 (0.04)
PCTShareOwn	-	-2.95 (1.63)
MB	+	0.49* (0.21)
StockWealth	+	0.00 (0.00)
Not independent boards:		
	Expected Sign	
Intercept	+	-8.18 (14.76)
NoiseROE	+	-0.01 (0.02)
NoExer5	-	-5.65 (3.97)
AGE	+	0.53 (0.32)
FCF	-	-52.16 (51.29)
leverage	-	1.20 (1.75)
PCTShareOwn	-	-22.94* (11.84)
MB	+	-5.23 (6.37)
StockWealth	+	0.00 (0.00)
Nobs		326

Table 8. The dependent variable is the ratio of equity compensation to cash compensation. Regression results for firms that fall in the outer quartiles of Market-to-book. The regression is the result of double clustering the standard errors on firm firm and year. The statistical

significance is represented by * (1%), ** (5%), * (10%).** $\frac{EquityComp}{CashComp} = \beta_0 + \beta_1 * noiseROE + \beta_2 * age + \beta_3 * FCF + \beta_4 * leverage$

$$+ \beta_5 * PctSharesOwned + \beta_6 * \frac{Market}{Book} + \beta_7 * StockWealth + \beta_8 * NoExer5$$

	Expected Sign	
Intercept	+	3.63 (4.47)
NoiseROE	+	0.00 (0.00)
NoExer5	?	0.02 (0.52)
AGE	+	-0.01 (0.08)
FCF	-	-0.39 (0.56)
leverage	-	-0.03 (0.09)
PCTShareOwn	-	-47.11*** (15.38)
MB	+	0.00** (0.00)
StockWealth	+	0.01*** (0.00)
Nobs		3605

To the extent that my model is misspecified, my results can be biased. If I have an omitted variable that is correlated with the overconfidence measure, the results and implications may change.

4. Outer Quartiles of Market-to-book Ratio

For the main analysis, I focus on the firms that would want to hire only rational or slightly overconfident CEOs. Limiting my sample to the firms with market to book that falls within the inter quartiles rank insures that I exclude start-up firms and firms near bankruptcy in the previous section. Firms in the highest quartile are more likely to be high growth firms, and those in the lowest quartile are more likely to be firms near bankruptcy. Because the Execucomp data consists of the S&P1500 firms, the outer quartiles market-to-book may not consist of only start-up firms in the highest quartile and only firms near bankruptcy in the lowest quartile. Therefore, it's likely that the firms in the outer quartiles are a mix of firms that want to hire rational, slightly overconfident, and extremely overconfident CEOs. As shown in section 2, slightly overconfident CEOs should be compensated with less equity than rational CEOs while extremely overconfident CEOs should be compensated with more. Since all three types of CEOs are expected for the firms in the outer quartiles of market to book, I don't expect to find a significant relationship between overconfidence and compensation mix.

H3: Firms in the outer quartiles of market to book should have little or no significant relationship between compensation mix and CEO overconfidence.

Table 8 shows the regression result. NoExer5 is positive but insignificantly different from zero. This supports hypothesis 3. Although not rejecting that overconfidence has no significant effect on compensation mix is not an ideal test, the results do show that firms who a priori want to hire either rational or slightly overconfident CEOs behave differently from firms that may want extremely overconfident CEOs.

5. Robustness Checks

Malmedier and Tate [19] use three measures for overconfidence: CEOs not exercising after 5 years when the stock price increased by 67%, CEOs not exercising options until the year of expiration, and CEOs described as overconfident or optimistic in the media. I used the first of these three measures in my main analysis. I have also used the second measure. The results are very similar.

Bryan, Hwang, and Lilien [6] use ROA as the accounting measure when calculating the "noise." I repeat the regressions and the results are again unchanged. Chhaochharia and Grinstein [7] use IRRC data before 2002 for differentiating between dependent and independent boards. Since Sarbanes Oxley was enacted in 2002, the difference between dependent and independent boards might be mitigated after 2002. I limit my board data to the years on or before 2002. The results are unchanged.

6. Conclusion

Given the empirical findings for overconfidence in CEOs and the theory that supports using compensation to maximize firm value for the different overconfidence levels, I test to see if firms are able to recognize the overconfidence of CEOs and whether the firms do compensate their CEOs accordingly. After controlling for the variables that should theoretically affect the compensation mix, I find that boards do know when their CEOs are overconfident. CEOs that are slightly overconfident are paid less in equity compared to rational CEOs, consistent with the theory. Firms seem to be able to save compensation costs when hiring slightly overconfident CEOs. Separating the sample by board independence, I find that strong boards are consistent in offering the overconfident CEOs less equity than the rational CEOs, but that weak boards do not appear to systematically offer different compensation mix for the overconfident CEOs. Consistent with my prediction, firms in the outer quartiles of market to book do not systematically offer different compensation mix for overconfident CEOs since outer quartiles of market to book contains firms that would want to hire CEOs with varying degrees of overconfidence.

References

- [1] Armstrong, Christopher, Alan Jogonalzer, and David Larcker, 2008. "Chief Executive Officer Equity Incentives and Accounting Irregularities," Working paper (accepted at Journal of Accounting Review)
- [2] Baker, Malcolm P., Ruback, Richard S. and Wurgler, Jeffrey A. 2005, "Behavioral Corporate Finance: A Survey" Available at SSRN: <http://ssrn.com/abstract=602902>.
- [3] Barber, Brad and Odean, Terrence. 2001, "Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment," The Quarterly Journal of Economics, Vol 116, No. 1, pp. 261-292
- [4] Bebchuk, Lucian Arye, Fried, Jesse M. and Walker, David I., 2002. "Managerial Power and Rent Extraction in the Design of Executive Compensation". University of Chicago Law Review, Vol. 69, pp. 751-846.
- [5] Ben-David, Itzhak, Harvey, Campbell R. and Graham, John R. 2007, "Managerial Overconfidence and Corporate Policies". AFA 2007 Chicago Meetings Paper. Available at SSRN: <http://ssrn.com/abstract=890300>.
- [6] Bryan, Stephen, LeeSeok Hwang, and Steven Lilien, 2000, "CEO Stock-Based Compensation: An Empirical Analysis of Incentive-Intensity, Relative Mix, and Economic Determinants," The Journal of Business, Vol. 73, No. 4, 661-693.
- [7] Chhaochharia, Vidhi, and Yaniv Grinstein, 2009, "CEO Compensation and Board Structure," The Journal of Finance, Vol.64 No.1, 231-261.
- [8] De la Rosa, Leonidas Enrique, 2007, "Overconfidence and Moral Hazard," University of Aarhus Economics Working Paper No. 2007-8. Available at SSRN: <http://ssrn.com/abstract=1141783>.
- [9] Gervais, Simon, Heaton, J.B. and Odean, Terrance, 2003, "Overconfidence, Investment Policy, and Executive Stock Options," Rodney L. White Center for Financial Research Working Paper No. 15-02.
- [10] Goel, Anand M and Anjan V Thakor, 2008, "Overconfidence, CEO Selection, and Corporate Governance." The Journal of Finance, 63.6: 2737.
- [11] Gompers, Paul, Joy Ishii, and Andrew Metrick, 2003, "Corporate Governance and Equity Prices," *Quarterly Journal of Economics* 118, 107-155.
- [12] Hall, Brian J. and Kevin J.Murphy, 2002. "Stock options for undiversified executives," *Journal of Accounting and Economics*, Elsevier, vol. 33(1), pages 3-42, February.

- [13] Heaton, J.B., 2002, "Managerial Optimism and Corporate Finance," *Financial Management*, Summer 2002, Pg. 33-45.
- [14] Hribar, Paul and Yang, Holly, 2006, "CEO Confidence, Management earnings Forecasts, and Earnings Management", Available at SSRN: <http://ssrn.com/abstract=929731>.
- [15] Ludwig, Sandra, and Julia Nafziger, 2007, "Do You Know That I Am Biased? An Experiment," University of Munich.
- [16] Petersen, Mitchell, 2009. "Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches," *Review of Financial Studies*, 22(1):435-480.
- [17] Sloan, R., 1993. Accounting earnings and top executive compensation. *Journal of Accounting and Economics* 16, 55-100.
- [18] Ulrike Malmendier, Geoffrey Tate, 2005, "CEO Overconfidence and Corporate Investment," *The Journal of Finance* 60.6: 2661-2700.
- [19] Ulrike Malmendier, Geoffrey Tate, 2008, "Who makes acquisitions? CEO overconfidence and the market's reaction. " *Journal of Financial Economics* 89.1: 20.