Why is CEO compensation excessive and unrelated to their performance?

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Abstract

We provide a simple model of optimal compensation in a setting where risk-neutral shareholders (the "principal") cannot fully observe and understand the set of business opportunities available to the firm (hidden information problem), nor can they fully monitor the decisions risk-neutral managers (the "agent") make in selecting the appropriate business opportunity (hidden action problem). The shareholders do observe the final cash-flow outcomes that arise from managerial choices and can set compensation that directly depends on these cash-flow outcomes (firm performance). We show that even when CEO has no bargaining power, value maximizing shareholders will set optimal compensation contracts in which CEOs will often earn rents over their outside options, the compensation will reward CEOs for "luck" and the CEO compensation will seem high even when firm's stock price falls.

1 Motivation

CEO compensation is contentious, particularly in times of recessions or economic crises such as the one the U.S. is experiencing today. More generally, the phenomenal rise in CEO compensation in the last couple of decades (Frydman, 2007) has led to concerns that "greedy" managers may have captured the pay-setting process to their selfish advantage (Bebchuk and Fried, 2003). Bertrand and Mullainathan (2001) find that executives are paid for firm performance that might be driven by good performance of the entire sector that may be largely unrelated to managerial actions. Furthermore, Garvey and Milbourn (2006) document an asymmetry in CEO pay – CEO pay is high following positive sector performance ("good luck") but CEO pay does not appear to be sufficiently low following negative sector performance ("bad luck").

We provide a simple model of optimal compensation in a setting where risk-neutral shareholders (the "principal") cannot fully observe and understand the set of business opportunities available to the firm (hidden information problem), nor can they fully monitor the decisions risk-neutral managers (the "agent") make in selecting the appropriate business opportunity (hidden action problem). The shareholders do observe the final cash-flow outcomes that arise from managerial choices and can set compensation that directly depends on these cash-flow outcomes (firm performance). We show that even when CEO has no bargaining power, value maximizing shareholders will set optimal compensation contracts in which CEOs will often earn rents over

their outside options, the compensation will reward CEOs for "luck" and the CEO compensation will seem high even when firm's stock price falls.

These results arise because the manager may engage the firm in a business that destroys firm value but provides sufficiently high non-pecuniary benefits (from empire-building, power, media recognition etc.) to the manager.[1] Shareholders must provide incentives to the manager so he would not make value destroying choices but would choose actions that generate the maximum value for the firm. Sometimes, the value maximizing project that is available to the firm will be a high growth "risky" project with an exogenous probability (that may, for instance, depend on favorable industry or sector conditions) of a high cash-flow outcome in the long run and other times the value maximizing project will be a "Safe" project with a smaller value that generates a more certain cash-flow outcome even in the short run. It is reasonable to believe that the value destroying ("Bad") project that the manager may prefer would be similar (to avoid shareholder scrutiny) – but not identical – to the high-growth high-value ("Good") risky project. If the probability of the high cash-flow outcome is somewhat higher for the value increasing "Good" project than for the value decreasing "Bad" project, a compensation contract that offers a sufficiently large compensation in the high cash-flow state would induce managers to take the "Good" project (even though the high cash-flow state arises for reasons that have nothing to do with managerial actions). This may often involve paying the manager more

[1]The executive compensation literature often models the agency problem by arguing that managers have disutility of "effort" and may shirk without appropriate incentives.

than his outside option based on his marketable skills. The essential idea is to endow the manager with so much equity based compensation that it drowns any adverse incentives that come from private non-pecuniary benefits. Such a contingent compensation contract also guarantees the manager would enjoy a ceratin level of monetary compensation and private benefits were he to choose the "Bad" project. The firm must offer at least an equivalent monetary compensation to the manager for taking the "Safe" project when the "Good" project is not available to the firm. So when it becomes known that the high-value high-growth project is unavailable, the firm's stock price would fall to reflect revised expectations and yet the manager will be handsomely compensated nevertheless.

Notice that the optimal managerial compensation that induces the right managerial incentives results in short-term compensation that is unrelated to what would seem like firm performance in the short run as measured by its stock price. At the same time, compensation in the long run would have an option-like component with high compensation when the firm cash-flow is high for exogenous reasons.[2]

[2]In the executive compensation literature this result is often justified by arguing that managers are more risk-averse than shareholders and a convex payoff associated with a call-option like payoff may offset managerial conservatism resulting from their high risk-aversion.

2 The Model

Consider a simple model with three dates $t = 0, 1, 2$. At least two periods are needed to model compensation in the short and in the long run as well as distinguish firm performance based on cash-flows and stock prices (present value of all future cash-flows). A principal of a firm (the shareholders collectively) have to design a compensation contract for an agent (the CEO or manager). The compensation contract will be designed at date 0 in order to incentivize the CEO to engage in shareholder value maximizing activities that may yield cash-flows in the short-run (date 1) or in the long run (date 2) as detailed below. All agents are risk-neutral and we normalize the risk-free rate to zero.

At date 0 the CEO can do one of (at most) three things all of which require an initial investment of 0.[3] First, he can choose a 'Safe' project S that generates \$1 for sure at date 1. We may think of this as a run-of-the-mill management strategy that produces relatively safe cash flows in the short-run. Alternatively, the CEO can choose a 'Bad' or value-destroying project B. Think of this as a long-run growth prospect that produces uncertain cash flows at date 2 equal to R with probability $(p - \delta)$ and r with probability $(1 - p + \delta)$ where $R > 1 > r > 0$. The expected cash flows from project B is $V_B = (p - \delta)R + (1 - p + \delta)r$ but project B also yields the manager

[3]This is harmless as long as financing constraints do not induce additional distortions. To focus attention on the problem of executive compensation we assume that the firm has enough cash at hand to finance the chosen action and interpret cash flows as net of investment costs.

non-pecuniary private benefits of $B > 0$ that can be thought of as managerial private benefits from inefficient empire-building. We assume that

$$V_B + B < 1 \tag{1}$$

so that the action B is value destroying in comparison to the safe action S even after including managerial private benefits.

Finally, with probability $\phi \in (0, 1)$, the CEO may also have available a risky but value-enhancing 'good' project G at date 0. The good project yields cash-flows of R at date 2 with probability $p > (p - \delta)$ and cash flows of r otherwise. The CEO derives no private benefits from choosing the good project G. However, the expected cash flows from G, $V_G = pR + (1 - p)r$, are higher than that for any other action

$$V_G > 1. \tag{2}$$

We may think of action G as a value-enhancing but risky growth prospect, unlike B which is value-destroying in expected terms. The exogenous probability ϕ captures the frequency with which the firm encounters this profitable growth opportunity and ϕ may depend in general both on firm and industry characteristics as well as managerial ability.

When project G is not available, the CEO can only choose between S and B. In the first-best world where shareholders observe managerial actions, our assumptions imply that they would require the CEO to choose the value enhancing project G when it is available and the safe project S otherwise. We assume however that shareholders face two related agency problems, one of hidden action and the other of hidden information. Shareholders face a

hidden action problem because they cannot observe the project chosen by the CEO. They also face a hidden information problem because they do not observe whether or not project G is available. Cash-flows at dates 1 and 2 are however observable and verifiable and we assume that shareholders can tie CEO compensation to the realized cash flows in order to incentivize him to make the right choices at date 0. Because incentives are costly however, the agency problem may lead to distortions away from the first-best optimum as we show below.

Let w_1 denote managerial compensation at date 1, w_2 denote base managerial compensation at date 2 and W_2 the additional compensation he receives when date 2 cash-flows are high and equal to R. At date 0, the compensation contract must guarantee the CEO an expected utility at least equal to $u \geq 0$, his exogenous outside option. In addition, the CEO has limited liability. We assume that the firm has enough cash to pay the manager and accordingly ignore limited liability constraints on the firm side. Finally, we restrict attention to the case where $u < 1$ so that it is profitable to hire the manager to always implement the safe project S in the first best world.

In order to derive properties of optimal managerial compensation we proceed as follows. We first focus on the case where shareholders try to induce management to employ the first-best decision rule of choosing project G when it is available and project S otherwise. We call this decision rule (G,S) and find the lowest cost (highest shareholder value) means of inducing it. Next, we find the lowest cost means of inducing the CEO to choose the decision rule (S,S), in which the CEO always chooses the safe project S and foregoes

the value-enhancing growth project G even when it is available. We show that these are the only possible decision rules that shareholders may wish to induce. Finally, we compare the costs of inducing the two decision rules (G, S) and (S,S), in order to determine the optimal managerial compensation contract and associated decision rule as a function of the parameters.

2.1 Inducing growth: implementing the first best (G,S)

If shareholders induce the first-best decision rule, the date 0 expected shareholder value – which will equal the stock price P_0 if normalize the number of shares to equal 1 - is

$$P_0 = \phi(V_G - w_2 - pW_2) + (1 - \phi)(1 - w_1) \tag{3}$$

Shareholders choose w_1, w_2 and W_2 to maximize (3) subject to the following conditions.

The first condition ensures that the CEO would prefer to undertake G over B when G is available. That is

$$w_2 + pW_2 \geq w_2 + (p - \delta)W_2 + B \tag{4}$$

which is equivalent to

$$W_2 \geq \frac{B}{\delta}. \tag{5}$$

This condition illustrates that when δ is small, *i.e.*, when the Good and Bad projects are very similar, the additional compensation in the high cash-flow state W_2 would have to be sufficiently high to drown manager's adverse

incentives that arise from his private benefits B associated with the Bad project.

The second condition ensures that the CEO would prefer to undertake G over S when G is available. That is

$$w_2 + pW_2 \geq w_1. \tag{6}$$

The next condition ensures that the CEO would prefer to undertake S over B when G is not available. That is

$$w_1 \geq w_2 + (p - \delta)W_2 + B. \tag{7}$$

Notice that (6) and (7) imply (4) – if the manager prefers G to S and S to B then he must also prefer G to B, so that we can ignore (4) in what follows.

The following condition ensures that the CEO's expected compensation guarantees him at least a value u that he can obtain with his outside option based on his skills.

$$\phi(w_2 + pW_2) + (1 - \phi)w_1 \geq u. \tag{8}$$

Finally, the following conditions are limited liability constraints

$$w_1, w_2 \geq 0, W_2 + w_2 \geq 0. \tag{9}$$

Notice that either the incentive constraint (6) or the participation constraint (8) must bind, for otherwise one can lower W_2 slightly without violating any constraints and lowering the wage bill.

Substituting (5) in (7), we get

$$w_1 \geq w_2 + (p - \delta)W_2 + B \geq w_2 + p\frac{B}{\delta}$$

and thus $w_1 > 0$ since $w_2 \geq 0$ from (9) and $B > 0$. It then follows that either the incentive constraint (7) or the participation constraint (8) must bind, for otherwise one can lower the bonus $w_1 > 0$ slightly without violating any constraints and lowering the wage bill.

Suppose first that the participation constraint (8) does not bind. Then (6) and (7) both bind and we obtain $W_2 = \frac{B}{\delta}$ and $w_1 = w_2 + p\frac{B}{\delta}$. Furthermore, $w_2 = 0$ since otherwise one can lower w_2 (and commensurately w_1) and lower the wage bill. It then follows that the expected wage bill is $p\frac{B}{\delta}$ since with probability ϕ, project G is not available and the manager chooses project S and is paid $w_1 = p\frac{B}{\delta}$ and with probability $(1-\phi)$, project G is available and is chosen by the manager in which case he receives $W_2 = \frac{B}{\delta}$ with probability p and 0 otherwise. Since we had assumed that the participation constraint does not bind, this expected wage is strictly greater than manager's outside option, $p\frac{B}{\delta} > u$.

Now suppose that $u = p\frac{B}{\delta}$, then the optimal contract must also have $w_1 = p\frac{B}{\delta}$, $w_2 = 0$ and $W_2 = p\frac{B}{\delta}$ because we have seen that it implies an expected wage bill of $p\frac{B}{\delta}$ and increasing w_1,w_2 or W_2 will increase the expected wage bill violating the condition $u = p\frac{B}{\delta}$.

It remains to consider the case where $u > p\frac{B}{\delta}$ and the participation constraint (8) binds. Substituting this constraint into the objective function, it is easy to verify that any set of w_1, w_2 and W_2 that satisfies the remaining constraints is an optimal contract. One such optimal contract has $W_2 = \frac{B}{\delta}$, $w_2 = u - p\frac{B}{\delta}$ and $w_1 = u$.[4] We collect these observations into our first result.

[4]The contract that we focus on has the smallest possible component W_2 within the class

Proposition 1 *If shareholders wish to induce the first-best decision rule (G,S), then an optimal compensation contract that achieves this objective satisfies*

$$W_2 = \frac{B}{\delta},$$

$$w_2 = \max\left[0, u - p\frac{B}{\delta}\right],$$

$$w_1 = \max\left[u, p\frac{B}{\delta}\right]$$

and the date 0 expected shareholder value is

$$[\phi V_G + (1-\phi)1] - \max\left[u, p\frac{B}{\delta}\right].$$

Proposition 1 states that the manager may earn rents above his outside option even when he has no bargaining power and shareholders hold all rights over contracting. The CEO earns rents in the first instance because shareholders have to guarantee him a date 2 expected payment of at least $p\frac{B}{\delta}$ in order to induce him to choose the value enhancing project G over the value destroying project B, *i.e.*, because of the hidden action problem. Because of the hidden information problem however, the CEO may not choose the safe project S when the value enhancing project G is not available. As a result, shareholders have to guarantee an expected payment equal to $p\frac{B}{\delta}$ regardless of the choices available to the manager. When the CEO's outside option u

of optimal contracts. Contracts with $W_2 > \frac{B}{\delta}$ but $w_2 = u - pW_2 \geq 0$ and $w_1 = u$ are, for instance, also optimal. This indeterminacy will have no bearing on shareholder well-being since the expected payment to management does not vary across optimal contracts. It will also have no bearing on the optimal decision-rule that shareholders wish to induce.

is less than the amount $p\frac{B}{\delta}$ that the manager must be guaranteed, the participation constraint does not bind and the CEO earns rents over his outside option.

2.2 Foregoing growth: implementing (S,S)

If shareholders always implement the safe project S, the expected shareholder value is

$$1 - w_1 \tag{10}$$

Shareholders choose w_1, w_2 and W_2 to maximize (10) subject to the following constraints:

$$w_1 \geq w_2 + (p - \delta)W_2 + B \tag{11}$$

$$w_1 \geq w_2 + pW_2 \tag{12}$$

$$w_1 \geq u \tag{13}$$

$$w_1, w_2 \geq 0, w_2 + W_2 \geq 0 \tag{14}$$

The first two constraints are incentive constraints ensuring that the safe action is better for the CEO than either the bad or the good action. The third constraint is the participation constraint while the last one is the limited liability constraint. It is immediate that one optimal contract is $w_2 = W_2 = 0$ and $w_1 = \max[B, u]$.

Proposition 2 *If shareholders wish to induce the decision rule (S,S), then an optimal compensation contract at date 0 that achieves this objective is*

$$w_1 = \max[B, u],$$

$$w_2 = 0,$$

$$W_2 = 0$$

and expected shareholder value is $1 - \max[u, B]$.[5]

2.3 Optimal compensation and decision rules

The two decision rules characterized above are the only two rules that shareholders may wish to implement. In particular, because of our assumption (1) that project B is value destroying even after taking into account the managerial private benefits B, it is never optimal to induce the manager to choose project B whether or not G is available, since any such decision rule can be dominated by a decision rule where the manager chooses the safe action S or the good action G instead.

The optimal decision rule involves comparing shareholder value across the two cases described by Propositions 1 and 2. We have the following result.

Proposition 3 *Implementing the first best decision rule (G,S) is better for shareholders than foregoing growth and implementing (S,S) if and only if* $\phi > \phi^*(u)$ *where*

$$\phi^*(u) = \frac{\max\left[u, p\frac{B}{\delta}\right] - \max[u, B]}{V_G - 1}$$

The numerator in the expression above, $\max\left[u, p\frac{B}{\delta}\right] - \max[u, B]$, represents the extra payment to the manager the firm must make to ensure that he

[5] As with the previous result, the optimal contract is uniquely determined if and only if the participation constraint does not bind.

chooses the Good project when it is available. The shareholders weigh this cost against the expected benefit they would derive if the Good project is chosen. Since the Good project arrives with probability ϕ and the extra value associated with the Good growth project over and above the Safe project is $V_G - 1$, we obtain the critical value for ϕ above which it is advantageous to induce the first best decision rule.

Case 1: Outside option lower than private benefits ($u < B < p\frac{B}{\delta}$)

In this case, the CEO's participation constraint does not bind regardless of whether shareholders implement the first best rule (G,S) or the rule (S,S). In the latter case shareholders must pay the manager an amount equal to his private benefit B in order to earn gross cash-flow of 1. If they wish to induce the project G however, the CEO must earn a higher amount $p\frac{B}{\delta}$ whereas the shareholders get an extra $\phi(V_G - 1)$ in expectation. When $\phi > \phi^*(u)$, paying the manager (in expectation) the extra amount $p\frac{B}{\delta} - B = \left(\frac{p}{\delta} - 1\right) B$ is justified. Notice that in this case $\phi^*(u) < 1$ if and only if $V_G - 1 > \left(\frac{p}{\delta} - 1\right) B$. If the last inequality does not hold, then the extra value from inducing the project G does not justify the extra managerial rents that must be provided in order to induce management to choose it.

Case 2: High outside option ($p\frac{B}{\delta} < u$)

In this case, the manager earns his outside option no matter what decision rule shareholders wish to induce. As a result, $\phi^*(u) = 0$ and it is always better to induce the first best optimal choice of actions since it raises the gross expected cash flows by $\phi(V_G - 1)$.

Case 3: Outside option higher than private benefits but not too high ($B \leq u \leq p\frac{B}{\delta}$)

This is the most interesting case and also the one that is most relevant. It is reasonable to assume that private benefits B are non-trivial but not as large as what the manager could earn in his next best outside alternative u.

In this case, firms with a relatively low prior likelihood ϕ of encountering a profitable growth opportunity are likely to induce management to choose the safe project and forego the growth opportunity. Managers will be compensated by a flat salary $w_1 = u$ and will not earn any rents over their outside options.

In contrast, when the likelihood of encountering a profitable growth opportunity is relatively high, shareholders prefer to induce the first best decision rule and undertake the growth opportunity when it is available. The CEO earns rents over his outside option when the first best decision rule is implemented.

Managerial compensation and its relationship to firm performance has interesting properties that are consistent with stylized facts that have typically been ascribed to managerial power and corruption. The long run compensation in the optimal contract will depend on firm performance. In particular the date 2 managerial compensation must be of the form $w_2 = 0$ but $W_2 = \frac{B}{\delta}$. This can be thought of as an option-like contract that pays off only when the growth project succeeds. The short-run or date 1 payoff to the manager must also be non-trivial. When the manager shows short-run cash flows, the market will infer that the manager was unable to produce a profitable

growth opportunity and so the stock price must fall relative to its date zero level. Still, the manager's compensation must be quite high with $w_1 = p\frac{B}{\delta}$, the expected long run payoff to the manager.

The manager's long run compensation is determined by the hidden action problem, in particular the choice between value enhancing growth G and value destroying growth B, when the former is an available choice. The manager's short run compensation is determined by the hidden information problem. Since shareholders cannot tell whether the long run growth opportunity is value increasing or value destroying, they must incentivize the manager to refrain from choosing the value destroying long run growth opportunity B over the safe action S when the value increasing growth opportunity G is not available. The resulting combination of high long-run as well as short-run compensation implies that the manager will earn a rent over outside options. Indeed, he must be compensated handsomely even when the firm displays bad luck and reveals a lack of growth prospects.

The critical value of $\phi^*(u)$ above which the first best decision rule is induced is falling in u. While the expected gain from inducing this decision rule, $\phi(V_G - 1)$, is independent of u, the extra expected payment to the manager, $(p\frac{B}{\delta} - u)$ is falling in u. As a result, as u rises, firms with low ϕ that previously did not find it advantageous to induce managers to choose the high growth Good opportunity may now wish to do so. A remarkable empirical implication of this is that if the market for managerial talent improves (say in economic booms) that raises the value of outside options (an increase in u), this may induce many firms to switch to offering very high compensation

contracts to managers ($p\frac{B}{\delta}$) – much more than a typical increase in u would suggest.

2.4 Robust Contracts

In the specific characterization of the Bad project choice that was available to the manager, in our model, the optimal contract involved a date 2 compensation that had an option-like characteristic, *i.e.*, a high payoff when the firm does well (returns R) and zero when the firm performance is low (returns r). These type of payoffs cannot, in general, be replicated by giving the manager an equity share in the long run cash flows. But this particular result arises because of the specific characterization of the Bad project. One could imagine that given the option-like compensation contract, the manager may be induced to find other Bad projects that produce a very high cash-flow in the state in which the call-option is in the money even though the project may even have a negative NPV. In such cases, restricting the date 2 compensation to a fraction of firm equity may indeed be sensible. Our intuition that a contract that gives the manager an equity stake that is large enough to drown any private benefits associated with projects that he might infer is quite robust. The manager will earn rents with such equity contracts and the other implications we derived from our model will continue to hold as well.

3 Concluding Remarks

Tim Cook was offered one million shares of Apple stock, worth nearly $400 million, when he was appointed CEO of Apple. His compensation at apple before he took over as CEO was high but not that high. Did his skills improve overnight dramatically? Almost surely not. The large equity stake would ensure that he is not tempted to take on projects that he might prefer even though they may not be in the best interest of Apple shareholders, we have argued in our paper.

Carol Bartz, the ex-CEO of Yahoo, received nearly $10 million when she was fired as the CEO of Yahoo last year. Her annual compensation in previous years was around $40-50 million. The Yahoo stock had fallen substantially when she was fired and yet offered a handsome compensation – probably much more than what she was making before she joined Yahoo and possibly what she will make after getting fired. Our model illustrates why high compensation packages even when firm stock prices fall may result from optimal compensation contracts in which shareholders, not managers have bargaining power.

What can we say about the seemingly high magnitudes of CEO compensation? An annual compensation of around $40-50 million might be worth 10 to 20 times that amount in total present value of around a half to one billion dollars. For a firm, such as Yahoo, with total market capitalization of around $20 billion, the CEO compensation represents less than 2-5% of firm value. It may seem high but is probably not high enough compared to

potential value destruction that could be caused by wrong business decisions.

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