ARTICLE IN PRESS
JID: FRL [m3Gsc;July 18, 2017;10:6]
Finance Research Letters 000 (2017) 1–5
Contents lists available at ScienceDirect
Finance Research Letters
journal homepage: www.elsevier.com/locate/frl

The optimal timing of CEO compensation

Pierre Chaigneau*

Smith School of Business at Queen's University and HEC Montréal, 143 Union Street West, Kingston ON K7L 2P3, Canada

ARTICLE INFO

Article history:
Received 8 May 2017
Revised 23 June 2017
Accepted 15 July 2017
Available online xxx

JEL classification:
G34
J33
M52

Keywords:
Deferred compensation
Executive compensation
Principal-agent model

ABSTRACT

We extend a standard principal-agent model of CEO compensation by modeling the progressive attenuation of information asymmetries about firm value by shareholders in continuous time. The dynamics of the stock price process are affected by the continuous accumulation of exogenous shocks, and by the progressive resolution of information asymmetries. The optimal timing of compensation is the point in time at which the stock price is most informative about the manager's action. When exogenous shocks accumulate at a constant rate over time and information asymmetries are resolved at a decreasing rate, the optimal timing of compensation is the point in time at which these two rates coincide.

The structure of executive compensation has important implications for corporate governance and economic efficiency. In particular, the temporal dimension of executive compensation has recently been the subject of much debate. Paying the manager for performance shortly after he takes actions that affect his company, which is referred to as short-term compensation, has been criticized by institutional investors (e.g. BlackRock, 2012) and academics (e.g., Bebchuk and Fried, 2010). Indeed, many reports on executive compensation recommend a long-term focus, i.e., paying the manager for performance several years after he takes actions.[1]

In this paper, we extend a standard principal-agent model similar to Holmstrom (1979) and Dittmann and Maug (2007) along the temporal dimension, by allowing not one but a continuum of performance measures. This enables us to study the quality of performance measures at different points in time. In the case of equity-based compensation, the stock prices at different points in time will be more or less informative about past managerial actions, depending on the fundamentals of the agency problem. We then determine what is the point in time at which it is optimal to pay the manager, which we refer to as the "optimal timing" of compensation. In our model, supposing that the manager sells his equity holdings upon vesting, this measure is the same as the "duration" of executive compensation (Gopalan et al., 2014).

We explicitly model two forces that have opposite effects on the evolution of stock price informativeness over time. On the one hand, the accumulation of exogenous shocks makes the stock price more noisy as time passes. On the other hand, the progressive reduction in information asymmetries and in the corresponding mispricing, which we refer to as progressive "learning" by shareholders, make the stock price less noisy as time passes – we provide a new method for modeling this process in continuous time. We show that the optimal timing of compensation depends on how the rate at which exogenous

* Corresponding author.
E-mail address: pierre.chaigneau@queensu.ca

[1] A recent example is the 2017 Executive Remuneration Report by The Purposeful Company, a consortium of leading executives, investors, consultants, and academics.

http://dx.doi.org/10.1016/j.frl.2017.07.008
1544-6123/© 2017 Published by Elsevier Inc.

shocks accumulate in the stock price compares to the rate of learning. Thus, the model provides simple benchmarks against which compensation practices can be evaluated. In the case when exogenous shocks accumulate at a constant rate and the rate of learning decreases over time (i.e., there is more learning early on), we show that the optimal timing of compensation is the point in time when both rates coincide. An increase in the magnitude of exogenous shocks then results in more short-term compensation, whereas a uniform increase in the rate of learning results in more long-term compensation.

An important application of these results is to equity-based executive compensation. Empirically, whether compensation is short-term or long-term can be measured by the “duration” measure of Gopalan et al. (2014). Their paper relates the duration of executive compensation to project duration and firm risk, among other factors. Interestingly, our results emphasize that some of these measures have ambiguous effects on the optimal timing of compensation. For example, firm risk could be high either because exogenous shocks are large or because the initial mispricing due to information asymmetries is high; in our model, this results in shorter-term compensation in the former case, and in longer-term compensation in the latter.

1. The model

We consider a firm initially controlled by board and run by a manager whose “effort” affects the probability distribution of the firm’s payoff. At the contracting stage, the board offers a compensation contract to the manager. The manager is risk averse with utility of wealth u bounded from below and defined over the real line. If he accepts the contract offer, at $t = -1$ he chooses unobservable effort $e \in \mathcal{E} \subset [0, \infty)$ at cost $C(e)$, where $C' > 0$ and $C'' > 0$. As in Dittmann et al. (2010), $C''(e)$ is sufficiently high for the second-order condition to the manager’s problem to be satisfied, which guarantees the validity of the first-order approach. The manager’s objective function is additive in the expected utility of wealth and the effort cost.

The payoff produced by the firm is realized at time T, and is equal to $a + e + \sigma^N B_T^N$, where a is a parameter which captures the productivity of the firm’s technology e is the manager’s effort, $\sigma^N > 0$ measures the magnitude of exogenous shocks, and B_t^N is an unobserved Brownian motion defined on [0, T].[2] A liquidation of the firm at any time is infinitely costly, so that no profitable renegotiation is possible. For simplicity, the discount factor is zero.

We focus on the first step of optimal contracting in Grossman and Hart (1983): the board (the principal) designs a compensation contract which induces a given effort $e^\star$ from the manager (the agent) at minimum cost. This approach is standard in principal-agent models which focus on the structure of compensation.

From $t = 0$ to $t = T$, the stock price is set continuously by risk-neutral, unconstrained, and competitive investors according to their information.[3] We assume that only the manager and the board know the value of a, and that investors progressively learn the value of the conditional expected payoff $a + e + \sigma^N B_t^N$: for all $t \in [0, T]$, they observe a noncontractible signal v_t, where[4]

$$v_t = a + e + \sigma^N B_t^N - \int_t^T \sigma_s^U dB_s^U, \tag{1}$$

where B_t^U is an unobservable Brownian motion independent from B_t^N, and σ_t^U is a continuous square-integrable function which measures the magnitude of information asymmetries. Intuitively, investors observe an imperfectly informative signal at time t, which diverges from $a + e$ because of the accumulation of exogenous shocks from time 0 to time t (the term $\sigma^N B_t^N$) and the remaining information asymmetries at time t (the term $\int_t^T \sigma_s^U dB_s^U$). The dynamics of σ_t^U determine whether most of the diminution in information asymmetries occurs at the beginning or at the end of the time interval [0, T]: it mostly occurs at the beginning if σ_t^U is decreasing in t, and mainly towards the end if σ_t^U is increasing in t.

That the performance measure (the stock price) is a noisy measure of effort is standard in principal-agent models. An important difference with standard principal-agent models, though, is that we explicitly model two sources of risk which have opposing effects on the variability of the stock price as time passes.

2. The compensation contract

Among the set of contracts which induce participation and effort $e^\star$ from the manager, we derive the contract which minimizes the cost of compensation at the second-best. If the first-order approach is valid, the incentive constraint which guarantees that the manager optimally chooses effort $e^\star$ under the contract $W(S_t)$ writes as

$$\frac{d}{de}\mathbb{E}_{-1}[u(W(S_t))|a, e^\star] = C'(e^\star) \qquad \text{or} \qquad \frac{d}{dS_t}\mathbb{E}_{-1}[u(W(S_t))|a, e^\star] = C'(e^\star). \tag{2}$$

The manager accepts a contract $W(S_t)$ if and only if the following participation constraint is satisfied:

$$\mathbb{E}_{-1}[u(W(S_t))|a, e^\star] - C(e^\star) \geq \bar{U}. \tag{3}$$

[2] Therefore, $B_0^N = 0$, $B_t^N = \int_0^t dB_s^N$ for any $t \geq 0$, and $B_s^N - B_t^N \sim \mathcal{N}(0, s - t)$ for any $s > t$.

[3] We implicitly assume that firm insiders – the manager and the board – cannot trade the firm stock at any time, which is in line with the prohibition of insider trading. Trading would enable the manager to undo the contract, and trading by a board with inside information on a market without noise traders and with asymmetrically informed investors would result in a market breakdown.

[4] Investors know that $e = e^\star$ in equilibrium, but the signal is informative about a, which matters for firm value. This captures in a simple and tractable manner the notion that investors learn about a from a variety of sources. The information of investors on a prior to $t = 0$ is irrelevant, but it can be assumed that they have an improper prior.