Contract Incentives versus Market Incentives

Why Do Big Firms Pay More For Performance?

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Abstract

Cross-sectionally, executives' incentive pays (e.g. bonus, stocks and options) increase with firm size though they have the same total compensation. This paper proposes an explanation in a dynamic contract model with search frictions. The competition for managerial talents generates market incentives which substitute the standard contract incentives. Because market incentives decrease with firm size, bigger firms rely more on contract incentives and offer more incentive pays. The model is parameterized and estimated on ExecuComp and BoardEX data. I use the model to evaluate several regulations on executive pays that have been proposed or implemented.

Key Words:

executive compensation, firm-size pay premium, dynamic contract, moral hazard, search frictions

JEL codes:

M12, L1, D8

Note:

This is the introduction part of the paper.

You can find the full paper here:

http://bohuecon.github.io/docs/market_incentives.pdf

"Most models of (executive) incentives ... are static. It would be useful to add a dynamic moral hazard problem where incentives can be provided not only through contracts, but also by the ... the promise of being hired by a larger firm. This would, among other things, analyze how contracting incentives interact with hiring incentives."

"Directions for Future Research" by Edmans et al. (2017)

1 Introduction

Executives contribute to shareholder values by setting visions and strategies, building culture and values, organizing capital and human resources. Because their activities are hard to monitor, managers are rarely paid for their inputs. Instead, executive compensation is tied to various indicators of managerial effort such as firm performance. Gayle and Miller (2009) document that in $S\&P$ 1000 firms about 70% of the executives compensation are incentive pays in the form of options and stocks held or newly granted.

A salient feature of incentive pays is that cross-sectionally they increase with firm size. This is documented in the literature and is replicated in table 1 column (1). In the regression, the dependent variable is the log of delta, a standard measurement of incentives in contract, defined as the dollar change in firm related wealth for a percentage change in firm value.[1]The independent variable firm size is measured by market capitalization. It shows for 1% increase in firm size, the incentive increases by 0.6%. Current literature tend to explain this fact by total compensations. Because big firm executives in general have higher total compensations, and given a concave utility function, highly compensated executives require higher incentive pays in dollars to get the same incentives in utiles. Edmans et al.'s (2009) model, for example, is in this spirit.[2]

However, if we plot the heatmap of incentives over two dimensions, the total compensation and the firm size, as in figure 1, and only compare executives with the same total compensation, still those in big firms get higher contract incentives.[3] This finding is confirmed in regression analysis. The positive correlation between incentive pays and firm size exists and is significant after controlling for total compensation in various forms, as shown in table 1 from column (2) to column (4). For 1% increase in the firm scale, the incentive measured by delta increases by 0.3%. This new fact, therefore, deserves explanations.

[1]Delta is also known as the "dollar-percentage incentive" or "wealth-performance sensitivity".

[2]Edmans et al.'s (2009) model assumes a multiplicative utility for executives. This implies the more executives are paid, the more incentive pays are required to induce their effort.

[3]The total compensation is the sum of salary and bonus, the value of restricted stocks and options granted, and value of retirement and long-term compensation schemes.These variables will be used throughout the paper. I divide the whole sample into 80×80 cells according to the total compensation and firm size, and compute the mean of $\log(delta)$ within each cell. This is plotted in figure 1.

Table 1: Incentive Pays Increase with Firm Size

	log(*delta*)			
	(1)	(2)	(3)	(4)
log(Firm Size)	0.578^{***}	0.295^{***}	0.274^{***}	0.273^{***}
	(250.03)	(112.20)	(104.10)	(103.68)
log(tdc1)		0.7159^{***}		
		(176.18)		
tdc1 Dummies (50)			Yes	
tdc1 Dummies (100)				Yes
Year FEs	Yes	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes	Yes
Year $\times$ Industry FEs	Yes	Yes	Yes	Yes
Observations	129458	129184	129185	129185

(a) The t statistics are shown in parentheses, and we denote symbols of significance by * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$;
(b) The dependent variable is the log of delta, where delta is the wealth-performance sensitivity defined as the dollar change in firm related wealth for a percentage change in firm value. The key independent variable is the log of firm size, where firm size is measured by firm's market capitalization. The key control variable is the level of total compensation, `tdc1` in ExecuComp dataset. All regressions control for year and industrial dummies and their interaction terms.
(c) Column (1) starts with a regression of log(delta) on log(firm size), which replicates the cross-sectional regression in the literature. From column (2) to column (4), I add in turns log(tdc1), tdc1 evenly grouped into 50 and 100 categories (then transformed into dummies).
(d) The data on delta is provided by Coles et al. (2006), Coles et al. (2013), and rest are included in the ExecuComp dataset, both are standard and public available.

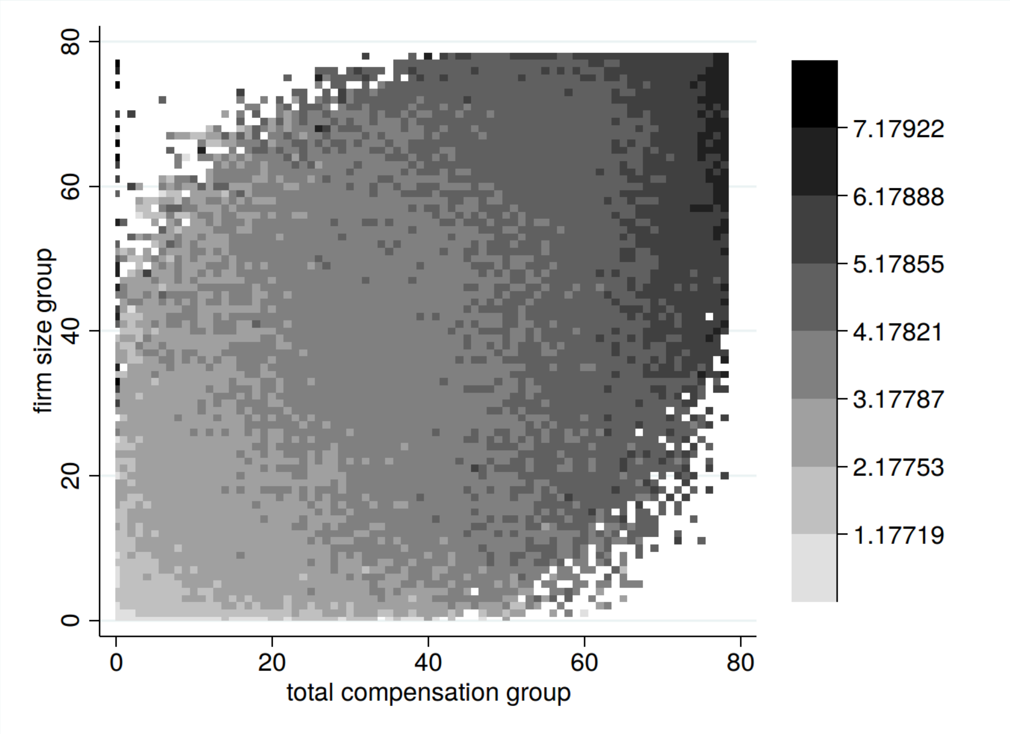

Figure 1: $\log(delta)$ over firm size and total compensation

Why do bigger firm pay more for performance even after controlling for total compensations? To explain, I consider incentives induced by the labor market, called the *market incentives* in this paper, which substitute or even replace the incentives offered in contract, the *contract incentives*. My explanation, in brief, is that the market incentives decrease in firm size; to keep up with enough total incentives, bigger firms provide more contract incentives.

Market incentives have been regarded as an alternative way to discipline worker's effort since Fama (1980).[4] In the classical career concern models (Holmström 1999; Gibbons and Murphy (1992), the labor market is assumed to be frictionless, hence, cross-sectionally market incentives are constant (as long as individuals have the same planning horizon, e.g. the years to retirement). However, the real world labor market is frictional, the market incentives — embedded in wage offers one expect to receive in the labor market — are not determined by a Walrasian auctioneer, but by negotiations which in turn depends on outside options, bargaining powers, employment histories, etc. As a result, workers on different rungs of the job ladder face different prospectives of market rewards for good performance. Intuitively, those who are on lower rungs of the ladder are more likely to be concerned with market incentives. Moreover, how frictional the market is influences how likely market rewards will be delivered in the future. I therefore use the substitution between two sources of incentives to explain the pattern of the contract incentives.

[4]The market incentives can also be referred as the career concerns, though the detailed mechanisms can be different in different models, see Grochulski and Zhang (2017) for a discussion.

In my model, market incentives arise because of the competition for managerial talents. An executive is approached by outside firms in a (search) frictional labor market. The outside offers can be used to trigger renegotiations with the current firm. In the renegotiation, the current and the outside firms essentially enter into a Bertrand competition where maximum bidding wages are monotonically increasing in the executive's expected productivity, and thus, from an ex ante perspective, bidding wages generate incentives for the executive's effort. The maximum bidding wage increases with the executive's productivity is the key to generate market incentives in the model.

Bigger firms are able to provide a set of higher bidding wages, but the incentives associated are lower. This is because utility is concave: at a higher wage level, a much larger variation of wages across productivities is required to provide the same incentive in utile. Therefore, the market incentives decrease with firm size. This implies that to address the same principle-agent issue, small firms may make use of market incentives while big firms have to provide more contract incentives. The key assumptions involved in this model are concave utility function, multiplicative production function, and search frictions in the labor market, and they are all standard.

Formally, I consider a dynamic contracting problem in which a risk-neutral firm hires a risk-averse agent/executive whose productivity is observable and persistent over time. The evolution of the executive's productivity depends on his effort and exogenous, idiosyncratic shocks, both of which are unobservable. The output is the executive's productivity scaled by the firm size. The contract between the firm and the executive specifies compensation and an effort recommendation for any realization of idiosyncratic shocks to the worker's productivity.

To explore the interaction of contracting incentives with market incentives, I embed this contracting problem into an equilibrium search model.[5] Executives search on-the-job (alternatively, they are approached by other firms while on-the-job). When there is a relevant outside offer, the executive uses that to renegotiate with the current firm. The renegotiation follows the sequential auction protocol (Postel-Vinay and Robin 2002). In terms of the contracting problem, on-the-job search implies two-sided limited commitment — executives and firms can terminate the relationship upon receiving better outside values. Despite these complications, I show that the optimal contract exhibits memory and inherits the essential properties of classical infinite repeated moral hazard model (Spear and Srivastava 1987).

[5]The real world labor market for executive-level jobs, just as labor markets for ordinary jobs, is full of informational and searching frictions. On the one hand, firms who have executive-level vacancies usually hire head hunters to find candidates. Once contact with the candidate is established, numerous ways including but not restricted to talks and interviews with the candidate and his/her previous colleagues are used to figure out whether the candidate is suitable. On the other hand, top managerial positions are limited, and can only be available upon the current executive leaves; at the same time suitable manager candidates are also limited, and can only be hired after negotiation and competing with the current employer. These are the reasons to describe the executive labor market as a search market.

The sequential auction between firms generates market incentives. The maximum wage firms are willing to bid depends on the productivity of the executive. Therefore, ex ante, the bidding scheme is an incentive scheme —- the executive works harder in order to increase his expected productivity so that firms are willing to bid more. This gives rise to the market incentives.[6] Executives, in big or small firms, all face market incentives, but how large the incentives are depends on the firm size. A small firm bids for the executive up to a much lower total compensation level than a big firm due to the scale effect in production, therefore a small variation in the small firm's maximum bidding scheme over productivities generates large incentives. At a higher wage level where bigger firms' bidding scheme locates, the same variation in bidding wages generates a much smaller market incentive. This is the case as long as the concavity of the utility function exceeds the scale effect in the production function, which is usually a very weak requirement. For instance, I show that with a CRRA utility the relative risk aversion is required to be bigger than one.

Solving numerically for this optimal contract becomes difficult in the presence of incentive compatibility constraint, limited-commitment constraint, together with shocks of large support.[7]The firms problem can be written recursively using promised utility (Spear and Srivastava 1987; Rogerson 1985) but one still needs to solve for the promised value in each state of the world in the next period. Following Marcet and Marimon 2017, Mele 2014, Farhi and Werning 2013, Lamadon 2016, I address this issue using the recursive Lagrangian approach. The Lagrangian multiplier represents the weight of the executive in a constructed Pareto problem, and it keeps track of the incentive compatibility constraint, limited commitment constraints and job-to-job transitions.

I bring my model to the ExecuComp dataset of $S\&P$ 1500 U.S. firms from 1992 to 2016. The sample includes top 5 to 8 executives in each firm year. I supplement the ExecuComp dataset with BoardEX dataset to identify the precise spell start and end dates, and whether each spell ends in a job-to-job transition. I provide direct evidence that (a) executives do transit between firms, with a transition rate around 5% each year; (b) executives are more likely to transit to bigger firms and (c) they have roughly the same job offer arrival rate. I then estimate the model's parameters by matching the process of firm profitabilities, executive job turnovers, sensitivity of executive wealth to performance in the data, etc. I find that the model quantitatively captures the pattern that bigger firm pay executives more for performance. I use the model to evaluate several regulations on executive pays that have been proposed or implemented. These exercises are still in progress and will soon be added.

[6]Compared to models with flat wage and with or without search frictions (Gabaix and Landier 2008; Tervio 2008; Postel-Vinay and Robin 2002; Cahuc et al. 2006; Lise et al. 2016), the competition in my model is not on one utility value but on an array of values contingent on the state of the world, and therefore results in a performance-based pay.

Related Literature

This paper contributes to the literature that explains the scaling of incentive pays with firm size. One line of research starts from Gabaix and Landier (2008) and Tervio (2008), where competitive assignment models of the managerial labor market, absent an agency problem, are presented to explain why total compensation increases with firm size. By assuming CEO's effort has a multiplicative effect on both CEO utility and firm value, Edmans et al. (2009) embed a moral hazard problem into the competitive assignment model. The model quantitatively generates predictions on wealth performance sensitivities that are consistent with the data. Edmans and Gabaix (2011) extend the model further to risk averse executives. This line of explanation relies on that total compensation increase with firm size, and it can not explain why after controlling for total compensation, the incentive pays still increase with firm size, which is the key question of this paper.

In another line of the literature, Margiotta and Miller (2000) derive and estimate a multiperiod principal-agent model with moral hazard. Based on this model, Gayle and Miller (2009) show that large firms face a more severe moral hazard problem, hence higher equity incentives are necessary in order to satisfy the incentive compatibility condition. Gayle et al. (2015)) embed the model of Margiotta and Miller (2000) into a Roy model with human capital accumulations, and they find that the quality of the signal is unambiguously poorer in larger firms, and that explains the most of the pay differential between small and big firms. Compared to these papers, my model highlights the role of a frictional labor market with on-the-job search, which generate cross-sectional variations in market incentives. In this way, my explanation of incentive pays does not rely on the heterogeneity of the moral hazard problems across firms, though this heterogeneity can be easily added. For example, I can assume the effort cost or the hazard ratio of working versus shirking changes with firm size in a proper parametric form. Yet, when these heterogeneities are included, how to identify the two sources of variations would be non-trivial. This is left for future research.

In terms of modeling, this paper builds on and links two strands of literature. One strand is the extensive literature on optimal long-term contracts with private information and(or) commitment frictions, e.g., Townsend (1982), Rogerson (1985), Spear and Srivastava (1987), Phelan and Townsend (1991), Harris and Holmstrom (1982), Thomas and Worrall (1990) and Phelan (1995). Compare to this literature, I model and add market incentives in the incentive compatibility constraint and analyze how this new source of incentives influence the optimal contract.[8]

Another important strand of literature uses structural search models to evaluate wage dispersions. For example, Postel-Vinay and Robin (2002), Cahuc et al. (2006), Lise et al. (2016) among others estimate models with risk-neutral workers and sequential auctions. Compare to this literature, I add a dynamic moral

[8] In my model, the largest firm basically faces a contracting problem without market incentives since there is almost no outside firm that can bid higher.

hazard problem which allows me to understand how market frictions influence a long-term contract. The extreme case in my model that firms with size below a threshold only pay a flat wage roughly corresponds to this type of models.[9]

This paper is also closely related to Abrahám et al. (2016), which aims to explain wage inequality in general labor market by combining repeated moral hazard and on-the-job search. Other than the differences in topics, there is a critical difference that distinguishes my model from theirs: the productivity (or output) of agents is persistent in my model while is independent in their model, and therefore in my model working hard today rewards the agent in the market tomorrow. This is also where my model is linked to the literature of career concerns (Holmström (1999), Gibbons and Murphy 1992). In the career concern models, the workers productivity level is persistent, yet the market needs to learn it. By exerting effort, the worker can manipulate the market belief and increase the spot wage he receives. In my model, productivity is observed once the executive and the firm meet. Yet due to search frictions, the reward is postponed to the future. Career concern models usually focus on the compensation difference along the time dimension while my focus is cross-sectional. Therefore, I need to model the labor market more realistically as a search market.

In Section 2, I present my model. I characterize the optimal contract and how incentives change with firm size in Section 3. In Section 4, I present the data and estimation. Section 5 decomposes the total incentives based on the estimates. I also studies several counterfactual scenarios to evaluate several regulations on executive compensation. And section 6 concludes.

[9] In my model, in some parameter set, firms smaller than a threshold will only pay a flat wage and all incentives come from the market. This case, though not very relevant empirically for the market that I am looking at (almost all executives in my sample are provided with some incentive schemes), it is consistent with other theoretical work such a Grochulski and Zhang (2017). This paves the way to study not only top managers' incentive compensation, but also that of mid-level managers and even rank-and-file employees, as suggested by Edmans et al. (2017).

[Incomplete Reference]

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