



FTG Working Paper Series

Competition for Talent under Performance Manipulation*

by

William Fuchs
Ivan Marinovic

Working Paper No. 00041-00

Finance Theory Group

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Competition for Talent under Performance Manipulation

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Competition for Talent under Performance Manipulation

Abstract

We study the effects of introducing competition for CEOs, assuming that the talent of CEOs is not observable and that they can misreport their performance. Without competition for talent, firms maximize their profits by offering inefficiently low-powered incentive contracts. Competition for talent removes those inefficiencies, but it leads to excessively high-powered incentive contracts, causing efficiency losses that can be more severe than the inefficiencies that competition mitigates. If misreporting is not a concern, however, then competition for talent has unambiguously positive effects on efficiency.

Keywords: *Executive Compensation, Competition for Talent, Adverse Selection, Moral Hazard, Misreporting, Performance Manipulation, Earnings Management*

JEL codes: *D82, D86, G3, M12*

1 Introduction

Competition for CEO talent has increased over the past few decades. As described in Frydman and Jenter (2010) and Murphy (2013), firms now regularly hire outsiders as CEOs instead of internal candidates, competing with other firms or poaching their CEOs, aided by compensation consultants and executive placement firms that create a market for CEOs and make compensation packages easier to compare.

What effects does such competition for CEO talent have? How does it affect the compensation contracts that firms and CEOs sign, the incentive power of those contracts, and the value that firms and CEOs create? The aim of this paper is to analyze the effects of introducing competition in a setting with realistic informational frictions, in order to understand how these frictions and the forces of competition jointly determine the outcome. We show that the ascent of competition increases the incentive power of CEO compensation contracts. This mitigates inefficiencies from low-powered incentive contracts that arise when firms do not compete, but it also introduces new inefficiencies caused by excessively high-powered incentive compensation. Which setup generates larger inefficiencies depends on the informational frictions.

We incorporate the following informational frictions in our model: Firms are uncertain whether a CEO has high or low talent; they cannot observe a CEO's decisions; a CEO can misreport her performance; and the long-term firm value is a noisy measure of how much value a CEO added. We are particularly interested in the role of misreporting in our results. We show that if misreporting is not possible, then competition for talent does not cause any inefficiencies and thus always increases the value that is created. If misreporting is possible, however, the contracts that competing firms offer to CEO candidates include excessively high-powered incentive compensation, leading to inefficiently high effort and aggressive misreporting, thereby causing inefficiencies that can outweigh the inefficiencies that competition mitigates.

Note that many firms offer significant incentive compensation to non-CEO top-level executives. In industries in which this is common and in which non-CEO executives are able to signifi-

cantly affect their firm's true and reported performance, our results extend to this set of executives.

The inefficiencies that arise under competition are different from those that arise without competition, because their causes are different. In the absence of competition, a firm maximizes its profit by offering a contract with incentive compensation that is inefficiently low-powered at low performance levels (a contract with the well-known "no distortion at the top" feature). The firm's goal is to offer low compensation to a high-talent CEO, without reducing her effort incentives. By reducing the incentive power at low performance levels, the firm can make it unattractive for a high-talent CEO to act as if she had low talent, exert low effort and generate poor performance. But the firm's profit is reduced if the CEO has *low* talent, because of the low-powered incentives at low performance levels (a low-talent CEO is expected to generate low performance). The firm trades off reduced compensation against lost profits, a trade-off that depends on the informational frictions. In particular, the possibility of misreporting exacerbates the inefficiency. But misreporting is not the driver of the inefficiency: The firm's profit-maximizing contract is inefficient even if misreporting is impossible.

Under competition for talent, the rivalry between firms forces them to offer contracts under which each CEO's expected compensation equals the value she creates — a firm's profit must be zero in equilibrium, because if it was not, a rival firm could design a slightly more generous contract and hire a CEO candidate instead.¹ This rivalry complicates the contract design problem: The contract must offer a high-talent CEO a large expected compensation, since having high talent makes a CEO more productive; but such high compensation should not induce a low-talent CEO to act as if she had high talent, misreport aggressively, earn a large compensation and cause a loss to the firm. Firms can prevent such mimicking behavior by making strong use of performance pay: A low-talent CEO benefits less from higher performance pay, since she is less productive, so acting as if she had high talent becomes less attractive. However, achieving this requires an excessively high-powered incentive contract, leading to excessive effort and misreporting by a

¹ This is a normalization and does not mean that a firm's profit is literally zero: Firms must obviously earn profits to cover their cost of capital. "Profit" should be interpreted as "abnormal profit". See also our discussion in Section 7.

high-talent CEO, thereby causing efficiency losses.

Competition for talent thus causes new inefficiencies that are very different from those arising in the absence of competition: Excessive incentive power at high performance levels replaces inefficiently low incentive power at low performance levels; and inefficiencies caused by profit maximization are replaced by inefficiencies that arise out of necessity, because firms are unable to hire a CEO without them.

By comparing the contracts, decisions and payoffs in the two setups (without and with competition for CEO talent), we can analyze the effects of introducing competition for talent. For all talent levels and performance levels, we obtain the following results. First, expected CEO compensation increases, because the rivalry between firms leads to more generous compensation packages. Second, the incentive power (pay-performance sensitivity) increases, because competition eliminates a firm's ability to offer inefficiently low-powered incentives at low performance levels while also requiring excessively high-powered incentives at high performance levels. Third, CEO effort increases, in response to the more powerful incentive compensation. Fourth, misreporting increases, also in response to the more powerful incentive compensation. These are important results in light of corresponding changes observed between the years 1980 and 2000: The size and incentive power of compensation increased (see Frydman and Jenter (2010) or Murphy (2013)), and there was an increase in misreporting (see Bergstresser and Philippon (2006), Burns and Kedia (2006), and Cohen et al. (2008)). The ascent of competition for talent during this period may have contributed to all these changes. Furthermore, these changes are not necessarily evidence of a worsening in corporate governance (Bebchuk and Fried (2003, 2004)).

While these effects of introducing competition for talent are unambiguous, the consequences for efficiency (value or surplus creation) can be positive or negative. Both setups (with and without competition) generate inefficiencies, but with different causes and magnitudes. Which efficiency loss is more significant under what circumstances is not immediately obvious.

Competition generates a *higher* surplus than the single-firm setup if the informational frictions

are not too large: If (i) misreporting is sufficiently difficult; (ii) a firm's long-term performance is a moderately noisy measure of how much value a CEO's added; or (iii) the CEO's risk aversion is low. Under these conditions, the equilibrium contracts under competition include only relatively small distortions. Consequently, the inefficiencies are smaller than in the setup without competition, where profit maximization leads to distortions even if the informational frictions are small. This implies that economies or industries with the following characteristics benefit from the ascent of competition for talent: (i) If strict disclosure regulations and active investors make misreporting difficult; (ii) if CEOs need to make decisions that will be key to their firm's performance over many years, such as responding to import threats, technological change, or new regulations, and the value-added of those decisions can be misreported in the short run but becomes observable in the long run; or (iii) if CEOs have high net worth and are thus able to diversify compensation risk (this makes compensation linked to the long-term value of the firm a more effective contracting tool).

In the extreme case, if misreporting is prohibitively costly, competition for talent leads to equilibrium contracts that are efficient, while the contracts offered in the single-firm setup remain distorted and thus generate less surplus. The ascent of competition for talent then eliminates inefficiencies without causing any new ones and thus unambiguously generates welfare gains.

But the ascent of competition for talent may also cause a reduction in the value created. This can happen if there are significant difficulties in linking compensation to performance: If the cost of misreporting is low, the CEO's risk aversion is high, and long-term performance is a noisy measure of true performance. Under these conditions, large efficiency losses arise in both setups, but they are larger under competition for talent. The excessive effort and misreporting induced in the competitive equilibrium from a high-talent CEO cause efficiency losses that outweigh those caused without competition (where the inefficiency is less relevant by comparison, because it affects a less productive low-talent CEO). For example, consider an industry in which firms have operations that are difficult for outsiders to analyze (say, because accounting rules and regulations

offer executives much leeway in their financial reporting) and furthermore, the CEOs' ability to diversify risk is limited because their net worths consist mostly of equity stakes in their firms. Our model predicts that in such an industry, the ascent of competition leads to efficiency losses.

Another situation in which the ascent of competition causes efficiency losses is when CEO talent is dispersed (has high cross-sectional variation), that is, if a low-talent CEO's effort is much less productive than a high-talent CEO's effort. The reason is that without competition, efficiency losses arise if the CEO has low talent, while efficiency losses arise under competition if a high-talent CEO is hired. If a low-talent CEO is much less productive than a high-talent CEO, then the inefficiencies caused without competition are less significant in absolute terms.

A similar intuition applies if the *probability* of hiring a low-talent CEO is small, that is, if most CEOs are "above-average" and only few have low talent. In the single-firm setup, the efficiency loss is small, because it is realized in the unlikely event that a low-talent CEO is hired. Under competition for talent, in contrast, the efficiency loss is large, because there is a distortion if a (more likely) high-talent CEO is hired.

The contribution of our paper is to shed light on how informational frictions determine whether competition for talent leads to efficiency gains or efficiency losses, focusing in particular on the role of misreporting. Since the various elements of our model (competition for talent and the informational frictions) have been analyzed separately in various strands of the literature, we discuss our paper's relation to the literature separately in Section 2. The rest of the paper is structured as follows. Section 3 presents the model and describes the efficient (value-maximizing) contracts. Section 4 discusses the optimal contracts in a setup with one firm. Section 5 characterizes the optimal contracts if firms compete for CEO talent. Section 6 discusses the effects of introducing competition. Section 7 explores possible extensions of the model. Section 8 concludes. All proofs and the derivations of some important equations are relegated to the Internet Appendix.

2 Literature

Our contribution is to study how informational frictions determine whether the ascent of competition for talent leads to efficiency gains or efficiency losses. Various strands of the literature study the building blocks of our model (competition for talent, and the informational frictions), but not in one comprehensive model. We show that it is important to analyze a comprehensive model: If misreporting is impossible, competition leads to an efficient outcome, whereas if misreporting is easy, the ascent of competition leads to efficiency losses.

Some of the existing work analyzes the role of informational frictions in isolation. CEO talent is studied in Kaplan et al. (2012), Albuquerque et al. (2013), Beyer et al. (2014), and Guay et al. (2014). Unobservable effort has been the workhorse model of the principal-agent literature since Holmstrom (1979). And there is a large literature on misreporting that studies both earnings management and large-scale cases of fraud (cases like Enron, Tyco International, Adelphia, Peregrine Systems or WorldCom). We focus on earnings management, because it is more common (Burgstahler and Dichev (1997); Bergstresser and Philippon (2006); Kothari et al. (2009); Dichev et al. (2013)). Some work studies how incentive compensation affects misreporting (Stein (1989); Fischer and Verrecchia (2000); Kirschenheiter and Melumad (2002)) or how compensation should be structured if firms anticipate some misreporting (Dye (1988); Liang (2000); Sankar and Subramanyam (2001); Goldman and Slezak (2006); Drymiotes and Hemmer (2013); Beyer et al. (2014); Dutta and Fan (2014)). The model in Beyer et al. (2014) is similar to the single-firm setup in our paper, as it incorporates unobservable talent, unobservable effort, and misreporting. None of these papers consider the role of competition for talent.

The effects of competition for talent have been analyzed in settings with few or none of the informational frictions that we include in our model. Frictionless labor markets are analyzed in Lucas (1978), Rosen (1981), and Terviö (2008), who predict that more talented CEOs earn higher rents. Gabaix and Landier (2008) additionally assume that CEO talent is more productive in larger firms, which leads to more talented CEOs being employed by larger firms and earning higher

rents. (We abstract from firm size in our model, but we explain in Section 7 how it could be integrated.) Edmans et al. (2009) add an effort-choice problem to the Gabaix and Landier (2008) model. Competition generates *efficient* outcomes in all of these models, a result we also obtain if we do not allow for misreporting. This shows the importance of incorporating the possibility of misreporting in the analysis.

Unobservable talent creates an adverse selection problem in our model. Competitive equilibria under adverse selection were first analyzed in Rothschild and Stiglitz (1976). There are technical similarities between their results and ours: First, because of competition, firms must break even irrespective of a CEO's level of talent (without competition, it is sufficient to break even *on average*); second, because of that, the equilibrium contract does not depend on the distribution of talent; and third, an equilibrium may not exist if the probability of facing one particular type is too high. We go beyond their model by incorporating both an effort choice problem and misreporting.

Some work incorporates both adverse selection and moral hazard (but not the possibility of misreporting) in models of competition and also predicts that competition can lead to equilibrium contracts with excessive incentive power.

In Biglaiser and Mezzetti (1993), firms compete for workers whose ability and effort are not observable.² Their focus is on the firms' technologies, some of which have decreasing average returns to worker ability. This asymmetry can lead to equilibria in which firms with such decreasing returns hire low-ability workers and induce excessive effort, which is feasible because those firms enjoy market power in the low-ability segment of the labor market. This result is different from ours since excessive effort is induced from low-talent employees, not high-talent employees, and since this is driven by technological advantages enjoyed by some but not all firms.

Bénabou and Tirole (2016) consider an agent who must choose two types of effort, the first of which is not contractable and is exerted only because of an "intrinsic" motivation, whereas the second can be incentivized. In terms of disutility, the two types of effort are substitutes: Exerting

² We thank an anonymous referee for bringing this paper to our attention.

more of one type makes it more costly at the margin to exert the other. Competition for unobservable talent leads to contracts that over-incentivize the contractable effort. Our setup does not depend on unobservable “intrinsic” motivation: A CEO provides effort only if there are financial incentives to do so.³ Furthermore, our model incorporates a CEO’s ability to misreport her performance. This also allows us to distinguish short-term compensation (based on the reported performance) from long-term compensation (based on the realized firm value) and to capture the intuition that if a CEO misreports her performance, the realized long-term performance is more likely to be disappointing.

Finally, Bijlsma et al. (2012) show that financial institutions competing to hire traders of unknown talent offer equilibrium contracts with excessively strong incentives to take risk. There is no risk choice in our model, while there is no misreporting or effort choice in their model.

3 Model

There are $N \geq 2$ firms seeking to hire a CEO. There is one CEO candidate, and the firms offer compensation contracts to attract her.⁴ The sequence of events is the following. First, the manager privately observes her talent (productivity), measured by $\tau \in \{\tau_\ell, \tau_h\}$, with $\tau_\ell < \tau_h$ and probabilities $p_h \in (0, 1)$ and $p_\ell = 1 - p_h$. Next, the firms simultaneously offer contracts to the manager, who can accept at most one of them. Once hired, the CEO chooses an action $L \in \mathbb{R}_+$ (most easily interpreted as effort), which cannot be observed by the firms. The choice of L affects the future value of the firm, $y \equiv \tau L + \varepsilon$, where $\varepsilon \sim N(0, \sigma^2)$ is a random variable.

The future value y increases in both effort L and talent τ , with a multiplicative effect, i.e., effort is more productive at the margin if a CEO is more talented. That is not a necessary assumption

³ Bénabou and Tirole (2016) also derive some of their results for a modified model with two verifiable but noisy performance measures. As in their main model, “talent” has an additive effect on a firm’s output, which eliminates some interesting feedback loops. In our model, talent and effort have a multiplicative effect, so high-talent effort is more productive at the margin.

⁴ We could allow for more than one CEO candidate. The key assumption is that the number of CEO candidates is limited, so the firms must compete for CEOs.

for our results, but it seems reasonable to assume that “talent” raises marginal productivity, and doing so yields intuitive results.⁵ A model with additive effects (instead of multiplicative effects) would be easier to analyze, and it would generate some of our results, but other results would be implausible given our application. For example, efficient contracts would include incentive compensation whose pay-performance sensitivity is constant for all performance levels, i.e., it would effectively ignore talent.

Noise ε is added to τL because the realized future value of the firm depends on variables that are outside the CEO’s control. Denote the expected future value, the firm’s “performance”, by $q \equiv E[y] = \tau L$. After choosing an action L , but before ε is realized, the CEO can report the firm’s performance, but her report r can be different from the true performance q . Finally, after ε is realized, the CEO receives a transfer $w(r, y)$, based on the report r and the realized value y as stipulated in the contract.

The firms (and their shareholders) are risk neutral, and the profit from hiring the CEO is $y - w$. The firms design contracts that maximize their expected profits, anticipating the equilibrium decisions of the CEO (if hired). The CEO is risk-averse, and given a contract w , her payoff is

$$U = E[w] - \frac{\rho}{2} \text{Var}(w) - \frac{\xi}{2} L^2 - \frac{c}{2} (r - q)^2.$$

The CEO’s payoff is increasing in her expected compensation $E[w]$, but being risk averse, she bears disutility $\frac{\rho}{2} \text{Var}(w)$ if compensation is uncertain. Effort L causes disutility $\frac{\xi}{2} L^2$. Finally, the CEO suffers disutility $\frac{c}{2} (r - q)^2$ if she misreports performance (i.e., $r \neq q$). This assumption captures the idea that misreporting is costly, and that the marginal cost of misreporting is increasing in the extent of misreporting.⁶ The assumptions that the costs of effort and misreporting are quadratic

⁵ Alternatively, we could have assumed that effort is equally productive across talent levels, but that talent reduces the cost of exerting effort. The results would be the same.

⁶ In a more complicated model, such costs would be driven by penalties that follow different extents of revealed underperformance, the probability of misreporting being discovered, etc. In order to have a tractable model, we use a simpler setup with “state falsification costs” (see, e.g., Dye (1988); Lacker and Weinberg (1989); Maggi and Rodriguez-Clare (1995a); Fischer and Verrecchia (2000); Guttman et al. (2006); Crocker and Slemrod (2007); Kartik et al. (2007); Kartik (2009); Beyers and Guttman (2012); or Dutta and Fan (2014)). As will become clear below, we could allow for

are obviously not essential, but they simplify the exposition and analysis.

If the CEO candidate rejects all contracts, her expected payoff is normalized to zero. If her reservation payoff was type-dependent, the derivation of the optimal contract would be more complicated, and the results would depend qualitatively on the curvature of the relation between types and reservation payoffs; see Lewis and Sappington (1989), Maggi and Rodríguez-Clare (1995b), and Jullien (2000). By endogenizing the reservation payoff in our competition setup, we avoid this fragility, and we link the reservation payoff to the nature of competition instead of imposing it exogenously.

In order to maintain tractability, we restrict the contract to being affine, i.e., $w(r, y) = \alpha + \beta r + \delta y$, where α is compensation that is fixed, β measures the sensitivity of the CEO's compensation to her reported performance r , and δ measures the sensitivity to the realized value of the firm. Linear incentive contracts are a standard assumption in the literature. If we dropped the assumption that the firm's long-term realized value can be used to provide incentives (say, if σ or ρ were unbounded), we could let the firms design optimal *nonlinear* contracts. That would yield very similar results.⁷

When designing contracts, the firms face several frictions: A CEO's talent τ is not observable, and her effort L and performance q are also unobservable. This gives rise to adverse selection and moral hazard problems. The firms have access to imperfect contracting tools only. The realized future value is verifiable, but linking compensation to it causes disutility to the risk-averse CEO. The short-term performance report is verifiable, but the CEO can misreport the performance.

As is standard in the literature, we let firms offer menus of contracts and the CEO candidate accepts one of them. The firms may offer separating menus of contracts, or pooling contracts. In a separating equilibrium, different contracts are designed for different talent levels, and the CEO, who knows her talent, chooses the contract intended for her talent level. This is without

misreporting to also reduce the value of the firm, without changing the results qualitatively.

⁷ See an earlier version of this paper, Marinovic and Povel (2012), which furthermore allows for a continuum of talent levels.

loss of generality, and a menu of separating contracts can be converted into a non-linear incentive scheme with different pay-performance sensitivities at different performance levels (reported and realized).

A contract $w(r, y) = \alpha + \beta r + \delta y$ can be written as $w = \alpha + \hat{\beta}r + \hat{\delta}y - \xi(r - y)$, where $\hat{\beta} = \beta + \xi$ and $\hat{\delta} = \delta - \xi$. The term $\xi(r - y)$ resembles a “clawback” provision, which some firms are adding to their executive compensation contracts: If the realized future value y is below the reported performance r , some past bonuses must be returned. It does more than that, since it also *rewards* the CEO if the realized performance is *above* the reported performance. Adding a separate clawback term does not give a contract more power, and it does not change any of the decisions, since the only contractable variables remain the report r and the realized value y . Using similar arguments we could also make the cost of misreporting depend on $(r - y)$ instead of $(r - q)$, without changing any results (for details, see the Internet Appendix).

We assume that c is common knowledge and identical across firms, capturing the quality of the accounting and auditing rules, the usefulness of disclosure requirements and other regulations, the legal rights of directors and minority shareholders when dealing with CEOs, and the effectiveness of the market for corporate control and the legal system. In Section 7, we explain how we could generalize the model by allowing for firm-specific values of c . We abstract from type-dependent costs of manipulation, which can complicate the analysis (separation is harder if a high-talent CEO has a higher cost of manipulation, and easier otherwise). Implicitly, we are assuming that differences in CEO talent are more significant than differences in the propensity to manipulate performance measures, given an economy’s accounting rules, etc.⁸

⁸ We have analyzed a model in which a CEO’s cost of misreporting c is uncertain instead of her talent. That model suffers from a tension between efficiency and incentive compatibility, and it yields fragile results.

3.1 Effort and Reporting Choices

Given a contract w , the CEO's expected payoff is (after substituting τL for q)

$$u = \alpha + \beta r + \delta \tau L - \frac{\rho \sigma^2}{2} \delta^2 - \frac{g}{2} L^2 - \frac{c}{2} (r - \tau L)^2.$$

The first-order conditions (with respect to L and r) yield the optimal values of L and r ,

$$L(\tau, w) = \frac{1}{g} \tau (\beta + \delta) \tag{1}$$

$$r(\tau, w) = \frac{1}{g} \tau^2 (\beta + \delta) + \frac{\beta}{c}. \tag{2}$$

Intuitively, the optimal effort level L increases in the compensation that is linked to either the reported performance (higher β) or the realized future value of the firm (higher δ). Effort L increases the *expected* future value q , and linking compensation to $y = q + \varepsilon$ naturally induces effort, since y is a mean-preserving spread of q . Contracting on y is costly however, since the CEO is risk averse. Compensation for reported performance has two effects. First, it leads to misreporting: $r(\tau, w) > \tau L(\tau, w)$ if and only if $\frac{\beta}{c} > 0$. Second, it increases effort: While misreporting is possible, it is increasingly costly at the margin, and at some level of misreporting effort becomes an equally attractive way to increase reported performance. Note that due to the informational asymmetries, some extent of misreporting is unavoidable, and it is anticipated by the firms in equilibrium.

The incentive to exert effort depends on the sum of δ and β . We can thus define the *strength of incentives* $\varphi(w) = \beta + \delta$. We can further define the surplus generated by a contract and the corresponding optimal CEO decisions:

$$S(\tau, w) = \tau L(\tau, w) - \frac{\rho \sigma^2}{2} \delta^2 - \frac{g}{2} L^2 - \frac{c}{2} (r - \tau L)^2.$$

The first term is the expected future value of the firm; the second term is the CEO's disutility from having to bear risk; the third term is the CEO's disutility from exerting effort; and the fourth term

is the CEO's disutility from misreporting the firm's performance. Substituting $L(\tau, w)$ and $r(\tau, w)$ using (1) and (2), and rearranging, we obtain

$$S(\tau, w) = \frac{\tau^2}{g} (\beta + \delta) - \frac{\rho\sigma^2}{2} \delta^2 - \frac{\tau^2}{2g} (\beta + \delta)^2 - \frac{\beta^2}{2c}. \quad (3)$$

We can define an indirect utility function for the CEO, given a contract w ,

$$U(\tau, w) = \alpha + \beta r(\tau, w) + \delta \tau L(\tau, w) - \frac{\rho\sigma^2}{2} \delta^2 - \frac{g}{2} L^2(\tau, w) - \frac{c}{2} (r(\tau, w) - \tau L(\tau, w))^2. \quad (4)$$

Substituting $L(\tau, w)$ and $r(\tau, w)$ using (1) and (2), and rearranging, we obtain

$$U(\tau, w) = \alpha + \frac{\beta^2}{2c} - \frac{\rho\sigma^2}{2} \delta^2 + \frac{(\beta + \delta)^2}{2g} \tau^2. \quad (5)$$

The firm's expected profit, conditional on hiring a CEO with talent τ , is

$$\Pi(\tau, w) = \tau L(\tau, w) - (\alpha + \beta r(\tau, w) + \delta \tau L(\tau, w)). \quad (6)$$

Substituting $L(\tau, w)$ and $r(\tau, w)$ using (1) and (2), and rearranging,

$$\Pi(\tau, w) = \frac{\tau^2}{g} (\beta + \delta) - \alpha - \frac{\tau^2}{g} (\beta + \delta)^2 - \frac{\beta^2}{c}. \quad (7)$$

3.2 Participation and Incentive Constraints

A separating equilibrium consists of a menu of two contracts $w_h = (\alpha_h, \beta_h, \delta_h)$ and $w_\ell = (\alpha_\ell, \beta_\ell, \delta_\ell)$, such that a high-talent CEO prefers w_h to w_ℓ and a low-talent CEO prefers w_ℓ to w_h . The partici-

pation constraints are (using (5))

$$U(\tau_h, w_h) = \alpha_h + \frac{\beta_h^2}{2c} - \frac{\rho\sigma^2}{2}\delta_h^2 + \frac{(\beta_h + \delta_h)^2}{2g}\tau_h^2 \geq 0 \quad (8)$$

$$U(\tau_\ell, w_\ell) = \alpha_\ell + \frac{\beta_\ell^2}{2c} - \frac{\rho\sigma^2}{2}\delta_\ell^2 + \frac{(\beta_\ell + \delta_\ell)^2}{2g}\tau_\ell^2 \geq 0. \quad (9)$$

The incentive constraints are (for details, see the Internet Appendix)

$$U(\tau_h, w_h) \geq U(\tau_\ell, w_\ell) + \frac{(\beta_\ell + \delta_\ell)^2}{2g}(\tau_h^2 - \tau_\ell^2) \quad (10)$$

$$U(\tau_\ell, w_\ell) \geq U(\tau_h, w_h) - \frac{(\beta_h + \delta_h)^2}{2g}(\tau_h^2 - \tau_\ell^2) \quad (11)$$

This immediately implies that in any separating contract, the high-talent participation constraint (8) is not binding if the high-talent incentive constraint (10) and the low-talent participation constraint (9) are satisfied.

3.3 Surplus-Maximizing Efficient Contracts

As a benchmark, we describe the contracts that a benevolent planner would design for the firms. A benevolent planner's goal is to maximize the expected surplus, under the constraints imposed by the informational asymmetries. Specifically, the benevolent planner cannot observe τ or L , so all she can do is to design compensation contracts $w_i = (\alpha_i, \beta_i, \delta_i)$ (for $i = \ell, h$) that maximize the surplus, knowing that the effort level and the report are then determined by (1) and (2). Obviously, α_i does not affect the surplus, but it affects the allocation of the surplus. But a benevolent planner is not concerned with the *distribution* of the surplus, only with maximizing the surplus under the given constraints.

Lemma 1 (*Efficient Contracts*) *A benevolent planner, whose aim is to maximize surplus, offers contracts*

w_i^* (where $i = h, \ell$) such that $\beta_i^* = c\sigma^2\rho \cdot \delta_i^*$,

$$\delta_i^* = \frac{\tau_i^2}{(c\sigma^2\rho + 1)\tau_i^2 + g\sigma^2\rho}, \quad (12)$$

and such that the CEO's payoff and the firm's profit are non-negative. The surplus generated by a low-talent CEO can be allocated entirely to the firm or the CEO, or shared. The surplus generated by a high-talent CEO is always split, such that both the firm's profit and the high-talent CEO's payoff are strictly positive.

There exists a continuum of efficient contracts, with varying levels of α_h and α_ℓ . We will focus our attention on two particular pairs of efficient contracts: First, the contracts $w_i^* = (\alpha_i^*, \beta_i^*, \delta_i^*)$ (where $i = h, \ell$) that give the highest possible profit to the firm and the lowest possible rent to the CEO; and second, the efficient contracts $w_i^{**} = (\alpha_i^{**}, \beta_i^*, \delta_i^*)$ that give the lowest possible profit to the firm and the highest possible rent to the CEO (for details of α_i^* and α_i^{**} , see the proof in the Internet Appendix). By varying α_ℓ , it is possible to allocate the entire surplus generated by a low-talent CEO either to the firm or to the CEO. That is not possible with a high-talent CEO, however: With any efficient contract and a high-talent CEO, the firm's expected profit must be positive because any increase in α_h beyond α_h^{**} makes it attractive for a low-talent CEO to act as if she had high talent; and a high-talent CEO's payoff must be strictly positive because of asymmetric information about her talent level. This inability to freely transfer the value created under an efficient contract is the reason why the equilibrium contracts that we will derive for the single-firm setup and for the setup with competition for CEO talent are distorted, i.e., not efficient.

Intuitively, the efficient contract offers stronger incentives to exert effort to a high-talent CEO, i.e., $\varphi_h^* > \varphi_\ell^*$. The reason is that a high-talent CEO's effort is more productive at the margin, since talent and effort have a multiplicative effect on performance. It is reasonable to assume (as we do) that the effort of more talented CEOs is more productive. If talent and effort instead had additive effects on the firm's performance, an efficient contract would offer *identical* effort incentives to both high-talent and low-talent CEOs (for a proof of this result, see the Internet Appendix).

4 The Single-Firm Setup

We first consider a setup in which there exists only one firm instead of $N \geq 2$ firms, the case we analyze in the next section. The efficient contracts w_ℓ^* and w_h^* described in Section 3.3 are feasible in the single-firm setup, but they are not the optimal menu of contracts. The firm can make a take-it-or-leave-it offer, and it finds it optimal to distort the incentive power of the contract intended for a low-talent CEO, in order to extract some of the payoff a high-talent CEO would earn if the firm offered efficient contracts.

Lemma 2 (*Equilibrium Contracts with a Single Firm*) *If a single firm can offer contracts on a take-it-or-leave-it basis, it offers contracts w_i^{sf} (where $i = h, \ell$) such that $\beta_i^{sf} = c\sigma^2\rho \cdot \delta_i^{sf}$; $\delta_h^{sf} = \delta_h^*$; and*

$$\delta_\ell^{sf} = \frac{\tau_\ell^2}{(c\sigma^2\rho + 1)\tau_\ell^2 + g\sigma^2\rho + \frac{p_h}{1-p_h}(c\sigma^2\rho + 1)(\tau_h^2 - \tau_\ell^2)}. \quad (13)$$

The equilibrium contract in the single-firm setup distorts the effort of a low-talent CEO downwards, compared with the efficient contract (we have $\beta_\ell^{sf} < \beta_\ell^*$ and $\delta_\ell^{sf} < \delta_\ell^*$), while making a high-talent CEO choose the efficient effort level. This *no-distortion-at-the-top* feature is common in this type of adverse selection models (see, e.g., Mussa and Rosen (1978)).

The frictions in linking pay to performance affect the equilibrium contracts in an intuitive way. An increase in c makes it harder to misreport, so compensation linked to reported performance becomes relatively more effective. In response, the equilibrium contract reduces δ_i^{sf} and increases β_i^{sf} . The net effect on overall incentives φ_i^{sf} and effort provision is positive for both CEO types, since it becomes easier to provide incentives to perform. Thus, if the cost of misreporting is low, it is optimal to offer low-powered incentives (see also Goldman and Slezak (2006)), while high-powered incentives are optimal if c is high. But even in the limit as $c \rightarrow \infty$, as the firm's performance becomes de-facto verifiable, the single-firm contract targeted at a low-talent CEO remains inefficient: $\lim_{c \rightarrow \infty} \beta_\ell^{sf} < \lim_{c \rightarrow \infty} \beta_\ell^*$. The same holds if it becomes less difficult to link compensation to the realized future value, say, if $\sigma^2 \rightarrow 0$ or $\rho \rightarrow 0$. The inefficiency is caused by the firm's

bargaining power, and the CEO's ability to misreport is not the primary cause of the distortion.

5 Competition for Talent

Introducing competition for talent (N firms competing to hire one CEO) dramatically changes the analysis. Intuitively, the firms will compete away all profits that are available in the single-firm setting. However, the firms are limited in their ability to offer larger rents to high-talent CEOs, because incentive compatibility constraints must remain satisfied. Rents can therefore be offered only by changing both the transfers that depend on performance (reported and realized) and the effort levels induced by the equilibrium contracts.⁹ The reservation payoffs become endogenous and type-dependent: The firms must ensure that their contracts are at least as attractive as what the CEO, given her type, could earn at a competing firm. The analysis is complicated by equilibrium existence problems similar to those in Rothschild and Stiglitz (1976).

The firms design contracts that maximize their expected profits, but with additional constraints. First, the equilibrium profit must be zero *both* with a low-talent and with a high-talent CEO. That is more stringent than expecting a zero profit of zero *on average*. If the profit was negative for one type and positive for the other, a rival firm would offer a slightly more attractive contract to the type that generates a profit and poach the CEO if she is of that type; the first firm would then be able to hire only the CEO type that produces a negative profit. (The same zero-profit constraint for each type applies in Rothschild and Stiglitz (1976).)

Second, given this zero-profit condition for each talent level, the contract intended for a low-talent CEO must be efficient. Specifically, it must be the efficient contract w_ℓ^{**} that lets a low-talent CEO extract the entire surplus she generates. Suppose a firm offered a contract $\widehat{w}_\ell \neq w_\ell^{**}$ that lets it break even. If \widehat{w}_ℓ is an efficient contract, a rival firm could offer a slightly more generous efficient contract, hire the low-talent CEO, and make a profit. If \widehat{w}_ℓ is not efficient, then it does not

⁹ We abstract from complications that arise if a mechanism can ask a manager for information on the competitors' offers or can specify messages to be sent to competing mechanisms; see Peters (2001) and Martimort and Stole (2002).

maximize the surplus generated by a low-talent CEO, and again a rival firm could offer a slightly more generous *efficient* contract and make a profit. There is no threat of mimicking behavior by a high-talent CEO, since hiring a more productive high-talent CEO under a contract w_ℓ^{**} can only increase the firm's profit (the firm and the high-talent CEO would share the increase in the surplus above the surplus a low-talent CEO would generate; for details, see the Internet Appendix).

Attracting a high-talent CEO while letting her extract the entire surplus she generates is more complex, since a sufficiently generous compensation scheme may attract a low-talent CEO who would then misreport and causes losses to the firm. The equilibrium high-talent contract cannot be efficient, since even with the highest-payoff contract w_h^{**} , the firm's profit is strictly positive (see Lemma 1). The firms need to design a contract such that a high-talent CEO can realize a higher payoff than under w_h^{**} , without making it attractive to a low-talent CEO.

We can thus restate the firms' optimization problem. Their goal is to design a contract w_h^c that maximizes the payoff of a high-talent CEO, such that in conjunction with the contract $w_\ell^c = w_\ell^{**}$, the incentive constraints (10) and (11) are satisfied, and expected profits equal zero with either CEO type (so $U(\tau_i, w_i^c) = S(\tau_i, w_i^c)$):

$$\max_{\alpha_h, \beta_h, \delta_h} S(\tau_h, w_h) \tag{14}$$

$$\text{s. th.} \quad S(\tau_h, w_h) \geq S(\tau_\ell, w_\ell^{**}) + \frac{(\beta_\ell^* + \delta_\ell^*)^2}{2g} (\tau_h^2 - \tau_\ell^2) \tag{15}$$

$$S(\tau_\ell, w_\ell^{**}) \geq S(\tau_h, w_h) - \frac{(\beta_h + \delta_h)^2}{2g} (\tau_h^2 - \tau_\ell^2) \tag{16}$$

A pooling contract cannot be an equilibrium contract, since pooling contracts would allow for profitable deviations to separating contracts: If a firm breaks even with a pooling contract, it must expect to make a profit if the CEO has a specific talent level, and this will tempt other firms to poach that type of CEO. However, we consider pooling contracts as possible *deviations* from the equilibrium separating contract. The possibility of pooling deviations causes equilibrium existence problems if the probability of facing a high-talent CEO is too high; as in Rothschild and

Stiglitz (1976), an equilibrium exists only if p_h is below a cut-off p_o , which we define in the proof of Proposition 3.

Proposition 3 (*Equilibrium Contracts under Competition for Talent*) If $p_h \leq p_o$, firms competing to hire a CEO offer a menu of two contracts w_i^c (where $i = h, \ell$) such that $\beta_i^c = c\sigma^2\rho \cdot \delta_i^c$; $\delta_\ell^c = \delta_\ell^*$; and

$$\delta_h^c = \frac{\tau_h^2 + \sqrt{\frac{(c\sigma^2\rho+1)\tau_\ell^2(\tau_h^2-\tau_\ell^2)^2 + g\sigma^2\rho((\tau_h^2)^2 - (\tau_\ell^2)^2)}{(c\sigma^2\rho+1)\tau_\ell^2 + g\sigma^2\rho}}}{(c\sigma^2\rho + 1)(2\tau_h^2 - \tau_\ell^2) + g\sigma^2\rho}. \quad (17)$$

The equilibrium contracts under competition distort incentives, but the distortion is different from that caused in the single-firm setup: It affects a high-talent CEO, whose effort is distorted upward.¹⁰ The reason is that w_ℓ^c cannot be distorted, since a low-talent CEO must be offered the efficient contract w_ℓ^{**} (due to competitive pressure, as explained above). The low-talent incentive constraint is binding if the contracts are w_ℓ^{**} and w_h^{**} (see the proof of Lemma 1), so in order to offer larger rents to a high-talent CEO (larger than what she can extract under w_h^{**}) she must be offered higher performance-linked compensation. This reduces the surplus a high-talent CEO generates, but the CEO can extract more surplus in absolute terms than under w_ℓ^{**} . A low-talent CEO can be prevented from choosing the high-talent contract w_h^c only if the pay-performance sensitivity is so high that it makes the contract unattractive to her. Doing that is feasible, since the costs of both effort and misreporting are convex.

The equilibrium contracts are independent of the distribution of CEO talent. The reason for this is that a firm's profit must equal zero with either CEO type, not just on average, due to competition. That is different from the single-firm setup, where p_h affects the distortion of the low-talent contract w_ℓ^{sf} : The higher p_h , the less costly it is to distort the low-talent contract, since the firm is less likely to actually hire a low-talent CEO. While technically this is a screening model (the uninformed firms move first by offering separating contracts), the equilibrium in the competitive setup has the flavor of a signaling model, where the optimization focuses point-wise on one "type" at a

¹⁰ The formal proof of that result is in the proof of Corollary 4.

time. In the single-firm setup, the firm can trade off efficiency and rent extraction to improve its expected profit. Competition for talent eliminates this tradeoff, because the firms expect to earn zero profits in equilibrium, leaving no benefits for departures from efficient contracts. Instead, the distortion is introduced out of necessity: In order to break even, firms must offer the least-cost zero-profit separating contracts.

The probability of facing a high-talent CEO is not irrelevant, though. The separating equilibrium exists only if the probability p_h is not too high, since a high p_h makes deviations to pooling contracts attractive. The upper bound p_o is defined in the Internet Appendix. There, we also show that p_o is positive but smaller than one for low values of τ_ℓ . For increasing values of τ_ℓ , it decreases, and in the limit as $\tau_\ell = \tau_h$, we have $p_o = 0$, i.e., a separating equilibrium does not exist. In other words, the existence condition is most restrictive when the adverse selection problem is insignificant (i.e., the talent levels are very similar); and it becomes less restrictive as the adverse selection problem becomes more relevant.

Unlike the single-firm setup, the contracts under competition become efficient in the limit as the contractual frictions vanish. In the limit as $c \rightarrow \infty$, the efficient contracts w_h^{**} and w_ℓ^{**} let the CEO extract the entire surplus; the firm's profit is zero with both CEO types, and since the contracts are incentive compatible, there is no need to distort either of them. The same holds if it becomes easier to link compensation to the realized future value, say, if $\sigma^2 \rightarrow 0$ or $\rho \rightarrow 0$.

We thus obtain efficient contracts under competition if any of the informational asymmetries is dropped: If the talent levels are identical (or, more generally, observable); if there are no frictions in linking compensation to the realized future value (if the CEO is risk neutral, $\sigma = 0$, or if no noise is added to the performance, $\rho = 0$); or if manipulation is not a concern because its cost is prohibitively high ($c \rightarrow \infty$). It is the *combination* of the frictions that drives the upward distortion under competition for talent. The reason is that if any of the frictions is removed, compensation can easily be linked to performance, and separating the types does not require any distortions (specifically, it is possible to write efficient contracts that allocate the entire surplus to the CEO

with either type).

6 The Effects of Competition

We now analyze how competition for managerial talent affects the equilibrium contract and the outcome, compared with the single-firm setup. Competition for CEO talent has increased over the past few decades (see Hall and Liebman (1998); Frydman and Saks (2010); Frydman and Jenter (2010); Murphy (2013)). Many firms now appoint outsiders as CEOs, which was uncommon a few decades ago. Firms have also appointed CEOs from different industries. The role of compensation consultants has become important, creating competition for talent and providing both CEO candidates and boards of directors with information about compensation packages offered at different firms. However, the effect is not likely to have been equal for all firms. For example, in some industries the appointment of outsiders as new CEOs has remained rare, possibly due to the importance of firm-specific knowledge.

Corollary 4 *Competition for talent induces excessively high incentive power, effort, reports and performance, while lack of competition induces inefficiently low incentive power, effort, reports and performance.*

Formally,

$$\begin{aligned}
\varphi(\tau_h, w_h^c) &> \varphi(\tau_h, w_h^*) = \varphi(\tau_h, w_h^{sf}) \quad \text{and} \quad \varphi(\tau_\ell, w_\ell^c) = \varphi(\tau_\ell, w_\ell^*) > \varphi(\tau_\ell, w_\ell^{sf}) \\
L(\tau_h, w_h^c) &> L(\tau_h, w_h^*) = L(\tau_h, w_h^{sf}) \quad \text{and} \quad L(\tau_\ell, w_\ell^c) = L(\tau_\ell, w_\ell^*) > L(\tau_\ell, w_\ell^{sf}) \\
r(\tau_h, w_h^c) &> r(\tau_h, w_h^*) = r(\tau_h, w_h^{sf}) \quad \text{and} \quad r(\tau_\ell, w_\ell^c) = r(\tau_\ell, w_\ell^*) > r(\tau_\ell, w_\ell^{sf}) \\
q(\tau_h, w_h^c) &> q(\tau_h, w_h^*) = q(\tau_h, w_h^{sf}) \quad \text{and} \quad q(\tau_\ell, w_\ell^c) = q(\tau_\ell, w_\ell^*) > q(\tau_\ell, w_\ell^{sf}).
\end{aligned}$$

Under competition for talent, firms generally offer contracts with stronger incentives, i.e., compensation is more sensitive to performance, either realized (say, through stock awards or stock options) or reported (say, bonuses, or awards of stock or options contingent on earnings). Conse-

quently, competition for talent increases the effort exerted by CEOs, irrespective of their type, and also the reported and true performance.

Furthermore, a high-talent CEO's pay-performance sensitivity is *excessively* high, i.e., higher than what a benevolent planner would choose; this induces excessive effort and performance. The incentives targeted at a low-talent CEO also strengthen, but the strengthening merely removes the distortion faced by low-talent CEOs in the single-firm setup.

This implies that the large increase in stock and stock option compensation during the 1990s may be a natural consequence of the strengthening of competition for talent that many industries experienced during the same period. It is thus not necessarily caused by weak governance at firms whose CEOs can extract outsized compensation packages (see Bebchuk and Fried (2003, 2004)).

Stronger incentives lead to superior performance q , so our model implies that the ascent of competition for talent went along with a general improvement in the performance of all firms, irrespective of CEO talent and irrespective of how performance is measured. However, not all of the improved reported performance is real. Stronger incentives to perform also strengthen the incentive to misreport, so some of the improved reported performance may be increased misreporting.

Corollary 5 *Competition for talent exacerbates misreporting. Formally,*

$$r(\tau_i, w_i^c) - q(\tau_i, w_i^c) > r(\tau_i, w_i^{sf}) - q(\tau_i, w_i^{sf}), \quad i = h, \ell.$$

Competition for talent leads to increased misreporting, due to the higher-powered incentives induced by competition. Note that in equilibrium, no one is fooled by the misreporting. Like in a signal jamming model, misreporting is unavoidable, but in equilibrium, the shareholders (say) can back out the CEO's effort and talent level. Thus, misreporting here resembles earnings management, for example the use of accruals to improve a firm's reported performance.

The distortions in the two setups are very different, so their effects vary across the two setups,

and depending on the circumstances the efficiency losses may be more significant either with competition or in its absence. We now analyze under what conditions the ascent of competition for talent leads to an increase or decrease in the surplus (value created).

Given separating contracts w_h and w_ℓ , define the expected surplus as

$$E_i [S(\tau_i, w_i)] = p_h S(\tau_h, w_h) + (1 - p_h) S(\tau_\ell, w_\ell).$$

Comparing $E_i [S(\tau_i, w_i)]$ for both setups, we can then define the change in surplus ΔS caused by competition for talent (for details, see the Internet Appendix):

$$\Delta S = -p_h (c\sigma^2\rho + 1) \frac{\tau_h^2 (\delta_h^c - \delta_h^*)^2}{2g \delta_h^*} + (1 - p_h) (c\rho\sigma^2 + 1) \frac{\tau_\ell^2 (\delta_\ell^* - \delta_\ell^{sf})^2}{2g \delta_\ell^*}. \quad (18)$$

Proposition 6 *The ascent of competition for talent may increase or reduce the expected surplus.*

(i) *Competition for talent increases the expected surplus (a) if the cost of manipulation is large; (b) if the CEO's risk-aversion is small; or (c) if the future value is a precise performance measure.*

(ii) *Competition for talent reduces the expected surplus (a) if the cost of manipulation is small and either the CEO's risk-aversion is large or the future value is a noisy performance measure; (b) if the talent levels are sufficiently different (if $\frac{\tau_\ell}{\tau_h} < \underline{\xi}$ for some $\underline{\xi} \in (0, 1)$); (c) if the difference between the talent levels is sufficiently small (if $\frac{\tau_\ell}{\tau_h} > \bar{\xi}$ for some $\bar{\xi} \in (\underline{\xi}, 1)$); (d) if the probability of facing a high-talent CEO is sufficiently large (if $p_h > \bar{p}_h$ for some $\bar{p}_h \in (0, p_o)$); or (e) if the probability of facing a high-talent CEO is sufficiently small (if $p_h < \underline{p}_h$ for some $\underline{p}_h \in (0, \bar{p}_h)$).*

Proposition 6 shows that competition can be beneficial or value-destroying, depending on the relative importance of the contractual frictions in the model. There are two key elements to understanding the results in Proposition 6. First, if the informational frictions become insignificant, competition for talent leads to equilibrium contracts that are efficient, while the setup with a single firm does not (the firm's profit extraction motive for distortions remains). Second, the distortion

in the single-firm setup targets a low-talent CEO, while the distortion in the competitive setup targets a high-talent CEO. Since a high-talent CEO is more productive and generates a larger surplus under efficient contracts, distortions of her incentives (as happens under competition for talent) can lead to larger efficiency losses.

Result (i)(a) follows from considering the limit as $c \rightarrow \infty$: The competitive contract becomes efficient, while the single-firm contract remains inefficient. The same result holds if it is easier to use long-term compensation to provide incentives, either because the CEO's risk aversion is small (so noise added to the long-term compensation does not diminish its expected value), which explains result (i)(b), or because little noise is added to begin with, which explains result (i)(c). In each of these cases, separating a high-talent CEO from a low-talent CEO becomes easier, and it is possible to design an efficient contract that allocates the entire surplus generated by a high-talent CEO to that CEO — the cause of the distortion in the competitive setup vanishes.

Results (i)(a-c) imply that, all else equal, competition is more beneficial (a) in the presence of stricter disclosure regulations or more activist shareholders (captured by a higher c); (b) if CEOs are independently wealthy and can therefore diversify the risk exposure from owning shares and options in the firm they manage (captured by a lower ρ); or (c) if a firm must adjust to import threats, technological change, or a changed regulatory environment, and the value-added of a CEO's decisions is easy to misreport in the short run but becomes observable in the long run (a situation with low c and low σ).

The opposite result holds if the informational frictions are large. Specifically, if the costs of misreporting are sufficiently low *and* it is sufficiently costly to link long-term compensation to effort, then the distortions to a high-talent CEO's contract under competition cause large surplus losses, compared with the surplus generated under an efficient contract. This surplus loss is unavoidable, since the firms must separate the two CEO types in equilibrium. In comparison, the surplus loss in the single-firm setup is small, since here the distortion is targeted at a low-talent CEO, so it affects a smaller (in comparison) feasible surplus. This explains result (ii)(a).

A similar intuition explains result (ii)(b). If a low-talent CEO is much less productive than a high-talent CEO, any distortions to a low-talent CEO's contract become insignificant in comparison to distortions to a high-talent CEO's contract. In the limit as $\frac{\tau_l}{\tau_h} \rightarrow 0$, there is no surplus loss in the single-firm setup, while the competitive setup remains inefficient. In contrast, if the two talent levels are similar, the setup with competition destroys more value, because at the margin, distorting a more productive high-talent CEO's incentives is more costly; this explains result (ii)(c).

Results (ii)(d) and (ii)(e) concern the *distribution* of talent. If the probability p_h of facing a high-talent CEO is high, then the competitive setting leads to a lower surplus because it distorts the decisions of the more likely CEO type, while the single-firm setting does not. This explains result (ii)(d). Note that the probability p_h must not be larger than p_o , since otherwise an equilibrium does not exist in the competitive setup.

If p_h is small, the surplus loss is small in both setups: In the limit as $p_h \rightarrow 0$, both setups generate the same, efficient surplus. In the competitive setup, the distortion vanishes because the likelihood of facing a high-talent CEO (who faces inefficiently high-powered incentives) goes to zero; whereas in the single-firm setup, the distortion in the equilibrium contract intended for a low-talent CEO vanishes as $p_h \rightarrow 0$. However, the convergence is slower in the competitive setup. Formally, we show that $\lim_{p_h \rightarrow 0} \Delta S = 0$ and $\lim_{p_h \rightarrow 0} \frac{\partial}{\partial p_h} \Delta S < 0$. So for small but positive values of p_h , the competitive setup generates a marginally smaller surplus.

An implication of Proposition 6 is that competition for talent hurts industries in which firms are opaque and it is difficult to assess how much value a CEO is adding. In contrast, competition is beneficial in industries that are transparent.

We now study how the ascent of competition affects the compensation that a CEO can expect to realize. Frydman and Jenter (2010) argue that competition for talent may partly explain the rapid increase in both the level and the dispersion of CEO compensation observed in the U.S. in the last 30 years. Our model shows that the levels of compensation should indeed have increased, but the dispersion of compensation may increase or decrease with the ascent of competition. However,

the dispersion of CEO *payoffs* should increase. This highlights that intuitions about payoffs do not directly translate into predictions about compensation.

Define the dispersions of compensation in the single-firm and competitive setups as

$$\Delta_w^{sf} = E[w_h^{sf}] - E[w_\ell^{sf}] \quad \text{and} \quad \Delta_w^c = E[w_h^c] - E[w_\ell^c],$$

and similarly define the dispersions of payoffs in the two setups as

$$\Delta_u^{sf} = U(\tau_h, w_h^{sf}) - U(\tau_\ell, w_\ell^{sf}) \quad \text{and} \quad \Delta_u^c = U(\tau_h, w_h^c) - U(\tau_\ell, w_\ell^c).$$

Proposition 7 *Competition for talent increases payoff inequality, but inequality in terms of compensation may increase or decrease. Formally, $\Delta_u^c - \Delta_u^{sf} \geq 0$ and $\Delta_w^c - \Delta_w^{sf} \leq 0$.*

Obviously, competition for talent increases the expected payoffs for both types. Despite the upward distortion in a high-talent CEO's effort under competition, her payoff is increased by more than a low-talent CEO's. Thus, while both CEO types should welcome the introduction of competition, it benefits a high-talent CEO more.

The increase in payoff inequality does not imply that there is more inequality in the *compensation* of the CEO types. The reason is that competition for talent induces higher effort from both types, and compensation is the sum of the payoff a CEO earns and the various disutilities she suffers. Depending on the extents of the distortions that are induced in the two setups, this may lead to an increase or decrease in inequality. Figure 1 plots $\Delta_w^c - \Delta_w^{sf}$ for different values of p_h , for $c \in \{\frac{1}{2}, 1, 2, 4, 8\}$, $\sigma = 1$, $\rho = 1$, $\tau_\ell = 1$, $\tau_h = 2$, and $g = 1$. The plot suggests that the the change in dispersion of compensation (caused by competition) is smaller if p_h is higher. With a higher p_h , it is optimal in the single-firm setup to distort a low-talent CEO's effort downward by more, so the onset of competition increases her effort (and thus her compensation) by more.

Figure 1 suggests that if c is low, the dispersion of compensation increases, while it decreases if both c and p_h are sufficiently large. This is not a robust result though, since $\Delta_w^c - \Delta_w^{sf}$ increases

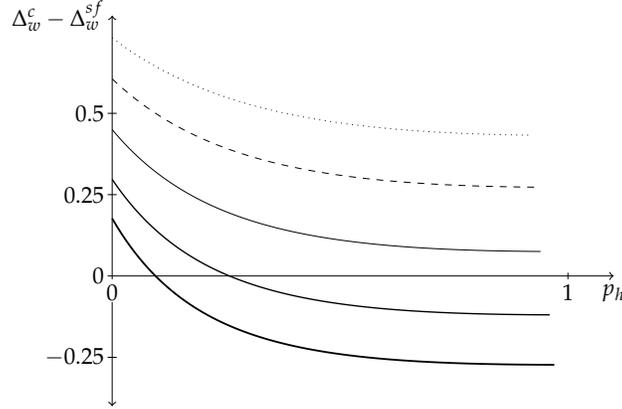


Figure 1: Increase in Dispersion of Compensation. This figure plots the increase in dispersion of expected compensation, for different probabilities p_h of facing a high-talent CEO (on the horizontal axis), given different costs of manipulation: $c = \frac{1}{2}$ (dotted), $c = 1$ (dashed), $c = 2$ (thin), $c = 4$ (medium), and $c = 8$ (thick). The other parameters are $\sigma = 1, \rho = 1, \tau_\ell = 1, \tau_h = 2, g = 1$. The graphs end at $p_h = p_o$ as defined for each value of c .

in c if g (which parametrizes the cost of effort) is very large.

Overall, the effects of competition for talent on income dispersion are fragile. This questions the validity of empirical work based on the “industry pay gap,” which regards the difference between a CEO’s compensation and the highest compensation package in the industry as a measure of how strong performance incentives are (see, e.g., Coles et al. (2017) or Nguyen and Phan (2015)). Our model shows that the dispersion of compensation may either increase or decrease if competition for talent is introduced (as was the case during the 1980s and 1990s), and therefore the “pay gap” may have increased or decreased even if incentives generally strengthened.

7 Extensions

We do not allow the cost of manipulation c to vary across firms. One could imagine that manipulation is easier at some firms and harder at others, maybe because some operations are opaque and others transparent, or because corporate governance is weaker at some firms than at others. Firms with higher values of c would be able to generate a larger surplus, allowing them to attract more talented managers, leaving less talented managers to the firms with lower values of c . Higher- c

firms would exhibit higher incentive power, generating larger surpluses. If the firms could increase c (by investing in governance, transparency, etc.), then competition for talent would create “governance externalities” between the firms, i.e., a firm’s investment in raising c would lead other firms to also invest in raising c (as in Acharya and Volpin (2010) and Dicks (2012)).

We could relax the assumption that CEOs extract the entire surplus under competition for talent. Suppose all firms have internal CEO candidates, whose talent τ_0 is known to each firm. We could rescale y as the value in excess of the value generated by an internal candidate. If $0 < \tau_0 \leq \tau_\ell$, the firms will not compete away all profits, given this “inside option.” If $\tau_\ell < \tau_0 \leq \tau_h$, the firms prefer an insider to a low-talent CEO, and they structure the contracts such that low-talent managers decline their contract offers. If $\tau_h < \tau_0$, the same happens to high-talent managers.

We could also assume that a manager’s reservation payoff is strictly positive, which would allow us to endogenize a manager’s decision to enter the labor market for CEOs. If τ_ℓ is low, the surplus generated and extracted by a low-talent CEO would be less than her outside option, and she would decline all contracts. This is more likely in the single-firm setup, which distorts a low-talent CEO’s effort and payoff downward. A high-talent CEO’s payoff is higher in both setups, so she is less likely to decline contracts in favor of an outside option. It may then happen that competition for talent worsens the pool of CEO candidates: Low-talent CEOs who would have declined all contracts in the single-firm setup may accept a contract under competition.

Finally, we could extend the model to allow for complementarities between firm size and CEO talent, as in Gabaix and Landier (2008). Let $s \geq 0$ be a measure of a firm’s size, and let the future value of the firm be $\hat{y} \equiv \tau_i (1 + s) L + \varepsilon$, where $\varepsilon \sim N(0, \sigma^2)$. For a given s , all results remain valid. An increase in size has effects identical to an increase in talent: Equilibrium incentives are strengthened, effort and misreporting increase, etc. Since firm size and talent are complements (as usual in assignment models), high-talent CEOs are hired by the largest firms, while in the absence of competition they might have been hired by small firms. Under those assumptions, incentives, effort and misreporting should be excessive at the largest firms, and they should be

efficient at small firms, after competition is introduced. Whether competition raises or reduces welfare would depend on the distribution of firm sizes, with ambiguous predictions similar to those for differences in talent (see Proposition 6).

8 Conclusion

We study how firms compete to appoint a CEO of unknown talent, whose performance on the job is not directly observable and can be misreported by the CEO. The equilibrium contract must ensure that each firm breaks even, given a CEO's (unobservable) talent and anticipating the CEO's type and endogenous effort choice. With a single firm, the focus is on extracting the highest possible profit, leading to contracts that induce inefficiently low effort from a low-talent CEO. If multiple firms try to hire a CEO, then the contract must also ensure that a CEO is not hired away by a competing firm. Due to the adverse selection, effort-choice and misreporting problems, the firms have to offer contracts that induce excessive effort from high-talent CEOs, and also excessive misreporting. Depending on the circumstances, the ascent of competition for CEO talent may be welfare-destroying.

The frictions in our model are both realistic and important, and the predictions of our model are consistent with empirical findings about CEO compensation over the past few decades, a time period during which competition for CEOs strengthened.

Our results show that the ascent of competition for CEO talent does not necessarily lead to improvements in the surplus generated by firms and CEOs. The possibility of misreporting, which has been the focus of a large accounting literature, has a crucial effect on whether the surplus increases or decreases. If misreporting is sufficiently difficult, the ascent of competition leads to surplus gains. In the limit, if misreporting is prohibitively difficult, the ascent of competition eliminates the inefficiencies that arise in its absence and leads to an efficient outcome. But if misreporting is easy, and linking measured performance to effort is generally difficult, the ascent of competition may decrease the surplus that firms and CEOs generate.

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