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I explore CEOs' incentives to select firm strategies and to acquire firm-specific skills when a few potential employers seeking to hire experienced CEOs create incentives for job-hopping. Several features of managerial compensation, such as benchmarking of pay to larger and more prestigious companies, payments unrelated to past performance, unrestricted stock awards for highly paid CEOs, long-term incentives, and higher pay in companies granting long-term incentives, emerge in the optimal contract. I argue that the model can jointly explain the surge in U.S. CEO compensation and the differences in the structure and the level of managerial compensation across countries and across firms within a country.

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Serial CEO Incentives and the Structure of Managerial Contracts[*]

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Abstract

I explore CEOs' incentives to select firm strategies and to acquire firm-specific skills when a few potential employers seeking to hire experienced CEOs create incentives for job-hopping. Several features of managerial compensation, such as benchmarking of pay to larger and more prestigious companies, payments unrelated to past performance, short vesting periods and unrestricted stock awards to highly paid CEOs, long-term incentives, and higher pay in companies granting long-term incentives, emerge in the optimal contract. I argue that the model can jointly explain the surge in U.S. CEO compensation and the differences in the structure and the level of managerial compensation across countries and across firms within a country.

JEL Codes: G32; J33; L14

Keywords: Optimal contracts, executive compensation, managerial labor market, firm-specific vs. general skills

I Introduction

Chief executive officers' (CEOs) compensation is at the center of the academic and policy debate, which has often criticized the high level of U.S. CEO compensation (Bebchuk and Fried, 2004). Not only CEO compensation has soared in the last two decades, but also the structure of executive pay has dramatically changed, as stock options and long-term incentive payments have become a larger share of compensation over time (Murphy, 1999; Frydman and Saks, 2010).

These changes have coincided with profound modifications of the managerial labor market. Some companies have started to look outside for replacing their CEOs and, in particular, hire experienced chief executives of other companies. As a consequence, executives do not consider to be arrived when they obtain the top job, but are aware that the first appointment to lead a company can be followed by a series of potentially more prestigious ones. Career paths like the one of Richard C. Notebaert are a good example of the *serial CEO* phenomenon:[1] Notebaert led the regional phone company Ameritech Corporation before its 1999 acquisition by SBC Communication Inc.; after, he held the top job at Tellabs Inc., a telecom-equipment maker; finally, in 2002, he became CEO of Qwest Communications International Inc.

Consistently with this anecdotal evidence, Murphy and Zabojnik (2007) document that an increasing number of CEO openings has been filled through external hires (instead of internal promotions) and that the percentage of outside hires with prior experience as a CEO of a publicly listed company has risen from less than 20 percent in the 1970s to nearly 50 percent in the 1990s. Murphy and Zabojnik (2004 and 2007) propose that an increased importance of general managerial skills can jointly explain the more frequent occurrence of experienced CEOs' external hires and the increase in pay of top level executives.

Fierce competition and other negative shocks may increase demand for the general skills of experienced CEOs in companies that need restructuring and radical changes. Firm-specific skills, however, appear to have remained important for firms under normal business conditions (Cappelli and Hamori, 2008; Cremers and Grinstein, 2008). I analyze how the optimal compensation contract is affected by the probability that competitors attempt to poach the CEO in firms where firm-specific skills are valuable.

Crucial for the analysis is the assumption that, while implementing the firm's strategy, managers

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[1] An article on the Wall Street Journal (2005) provides a vivid characterization of this phenomenon.

acquire skills that may be more or less useful in other firms. For instance, firm strategies can focus on external constituencies (such as analysts, investors, and medias)[2] or on internal operations (such as clients, suppliers, and employees). If a (firm-specific) growth opportunity becomes available, focusing on internal operations can greatly enhance firm performance in the long-run. However, by focusing on internal operations, the CEO acquires firm-specific skills that are unlikely to enhance her productivity in other firms and thus limit her chances to receive outside offers.[3] The CEO thus faces a trade off between pursuing a strategy that allows to acquire general skills, but does not necessarily maximize the firm's long-term value (self-enhancing short-term strategy), and pursuing a strategy that maximizes the firm's long-term value, but implies the acquisition of firm-specific skills and reduces the probability of attractive outside offers (value-enhancing long-term strategy).

In this context, a double moral hazard problem arises. First, the manager strategy choice is not observable and ex post verifiable. Also, general and firm-specific skills, being varied, cannot be enumerated in a contract and are therefore non-contractible. Second, without a contract providing ex ante commitment, after the strategy has been undertaken, the firm may have no incentives to share the surplus created by an efficient strategy choice with the manager. Many features of executive compensation as well as the large variety of managerial contracts emerge as an attempt to mitigate the inefficiencies caused by this double moral hazard problem.

Managerial labor market and firm growth opportunities have large effects on the structure of the optimal contract. With a thin managerial labor market, managerial incentives to acquire general skills are weak. The model shows that the CEO may undertake the value-enhancing strategy even if ex ante the firm does not commit to award a share of the long-term output to the CEO.

As opportunities for job hopping increase, large differences in the structure of contracts emerge and the level of compensation increases dramatically in some firms. When the labor market is deep, the CEO's expected payoff from the self-enhancing short-term strategy is large because she expects to receive attractive outside offers with high probability if she acquires general skills. The CEO has an incentive to choose the value-enhancing long-term strategy only if the firm commits ex ante to offer a large share of the long-term output. Since firm shareholders do not observe which strategies are actually available, having limited liability, the manager enjoys an informational rent

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[2]This can be thought as networking.

[3]Khurana (2002) suggests that skills, such as being able to effectively deal with analysts and investors, are highly-valued in CEOs' external appointments.

if it is not possible to pursue the long-term strategy.[4] The long-term contract is therefore costly for shareholders. If growth opportunities are strong (i.e., the ex ante probability that the value-enhancing strategy can be pursued high), firm shareholders find it optimal to offer high long-term compensation and the overall level of compensation increases. If instead growth opportunities are weak, firm shareholders find it optimal to offer relatively low and possibly short-term compensation. In equilibrium, the manager always selects the self-enhancing short-term strategy, but the expected cost of the inefficient strategy selection is lower than the (expected) informational rent that the manager would enjoy otherwise.

A major point of departure from previous literature on dynamic labor contracts (e.g., Rogerson, 1985 and Edmans, Gabaix, Sadzik, and Sannikov, 2010) is that in my model the manager is not committed to work with the firm for the entire duration of the contract but is able to quit. This allows features of managerial compensation, such as payments unrelated to past performance, to emerge in the optimal contract with the goal of reducing the managerial rent. For instance, in the model, managers that receive outside offers and decide to remain with the firm obtain windfall payments, unrelated to past performance. These payments appear unjustified rent extraction by the manager as outside offers are generally not observed. However, they are optimal because not only they allow the manager to continue a high return long-term strategy, but they also allow the firm to "screen out" managers that were unable to pursue the long-term strategy, because they always quit. Thus, from an ex ante point of view, these windfall payments unrelated to past performance decrease the managerial rent.

The model can also account for the increase in managerial turnover observed during the nineties, which is predicted to be higher for managers with long-term compensation. Since managerial rents are costly for shareholders, when growth opportunities are large, it may be optimal to offer the manager a contract such that the manager leaves (does not spend effort and has zero payoff from remaining with the firm) even without outside offers if ex post the long-term strategy turns out not to be available. If the long-term strategy is expected to be available with high probability, such a contract maximizes firm value net of managerial compensation, although it implies underprovision of effort.

The model also provides a rationale for the awards of stock options with short vesting periods

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[4]Since fixed salaries cannot fall below zero owning to limited liability, shareholders cannot accompany the increase in long-term compensation with a reduction in cash to keep overall pay constant.

to highly paid managers with strong incentives to acquire general skills. This is at first counter-intuitive because the main problem faced by the firm is related to CEO retention. Common sense would suggest that unrestricted stocks may merely increase the CEO's payoff from quitting and can never be optimal. The model shows that this is not necessarily true. The intuition is the following. The CEO has private information on whether the long-term strategy is available and whether she has undertaken it. If the manager finds it optimal not to sell stocks when she has positive private information, unrestricted stocks provide incentives to undertake the long-term strategy. A mix of restricted and unrestricted stocks may be the most efficient way of achieving an efficient strategy selection because by transferring rents from the second to the first period, they increase the value of compensation for impatient managers. This allows to increase the overall joint gains and ultimately the returns for shareholders. Thus, arrangements involving short vesting periods are optimal even if empirically one observes that CEOs tend to cash in before periods of weak performance. In fact, they deter short-termist incentives exactly because the manager has no incentives to cash when she has positive private information on the future prospects of the firm.

The main contribution of this paper is to propose an explanation for why the observed changes in U.S. executive compensation may be consistent with maximization of shareholder value, as suggested by Kaplan and Holmström (2003). The model proposes that liquid managerial labor markets lead managers to adopt a short-horizon on their tenure at the current job. The changes in managerial compensation observed during the nineties in the U.S. may be viewed as an optimal response to the increased opportunities for job-hopping arising from restructuring firms' propensity to hire experienced CEOs. This is consistent with the fact that managerial compensation in Japan and Continental Europe, where firms are less often managed by professional managers and managerial labor markets are thinner, did not change to the same extent.

Most of the literature on CEO compensation has focused on the contracting problems between a firm and a manager in isolation.[5] For instance, Hermalin (2005) argues that changes in corporate governance leading to greater board diligence and higher probability of dismissal increased the disutility of being a CEO and brought about higher executive pay. In Hayes and Schaefer (2009), firms increase pay in order to signal to market participants that they employ skilled CEOs.[6] These

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[5]Edmans and Gabaix (2009) provide an accurate recent survey.

[6]Edmans and Gabaix (2011) overturn Hermalin's (2005) result considering the general equilibrium effects of the executive labor market..

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papers have no implications for the structure of compensation.

A few papers have proposed that CEO compensation is better understood in the context of the managerial labor market (Murphy and Zabojnik, 2004 and 2007; Frydman, 2005). In particular, Gabaix and Landier (2007) and Terviö (2008) develop an equilibrium model in which increases in average firm size improve CEOs' outside options and, consequently, affect the level of compensation. Using a framework similar to Gabaix and Landier (2007), Baranchuk, MacDonald and Yang (2006), and Edmans, Gabaix and Landier (2009) evaluate how differences in firm size can account for differences in pay-performance sensitivity. Himmelberg and Hubbard (2000), Oyer (2004) and Rajgopal, Shevlin and Zamora (2006) explain the high pay-performance sensitivity and the lack of relative performance evaluation in managerial contracts with the fact that companies wish to offer their executives higher compensation when their outside options are more attractive. Acharya and Volpin (2010), and Dicks (2010) argue that the level of pay and pay-performance sensitivity are high because managers enjoy high rents in weak governance firms. In a competitive managerial labor market, firms may even weaken corporate governance to attract better managers (Acharya, Gabarro and Volpin, 2010).

Like me, all these papers explore the effect of outside options on CEO compensation. However, they do not analyze how the labor market affects CEOs' incentives and therefore have limited implications on the structure of executive compensation.[7] In particular, to the best of my knowledge, my paper is the only one to provide an explanation for why it may be optimal to grant short vesting periods and payments unrelated to past performance, and for why these contract features arise together with higher compensation and more long-term incentives.

Furthermore, all existing theories imply that the manager's outside option is the "next-best" alternative and, consequently, compensation should be benchmarked to firms with similar size, pay etc. Empirical evidence shows that firms benchmark their compensation to larger firms that are industry leaders and offer higher pay (Albuquerque, Franco and Verdi, 2009; Bizjak, Lemmon and Nguyen, 2009; Cadman, Carter and Semida, 2009; Faulkender and Yang, 2010). My model suggests that this is optimal when firm-specific skills are valuable and the manager may quit voluntarily. Finally, by considering managerial incentives, I am able to obtain differences in managerial contracts without assuming unobservable differences in talent, as, for instance, Murphy and Zabojnik

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[7]On the other hand, my model has no direct implications for the lack of relative performance evaluation, but can be consistent with it if the probability of receiving an outside offer is affected positively by market performance.

(2004 and 2007) and Gabaix and Landier (2007) do. Also, some argue that external hires of experienced CEOs are too infrequent to explain the changes in executive compensation (Cremers and Grinstein, 2008). In my model, managers pursuing long-term strategies do not accept outside offers in equilibrium. The mere possibility of an outside offer, however, requires a contract that corrects managerial incentives.

The paper is also related to the literature on human capital acquisition (Becker, 1993). The strategy choice can be regarded as the decision whether to invest in firm-specific skills. I analyze how this decision is affected by outside options and the bargaining power of the manager with respect to the firm, in presence of contract incompleteness, hold-up problems, and managers' inability to commit to continued employment. While some of these issues have been explored to analyze investment in general and firm-specific training and their effects on workers' wages (Malcomson, 1997; Williamson, Wachter and Harris, 1975), to the best of my knowledge, their insights have not been applied in the context of CEO compensation. This opens a completely new set of issues and contracting problems.

Finally, the theory is close in spirit to career concern models (Fama, 1980; Holmström, 1999) because I study, similarly to Narayanan (1985) and Stein (1988 and 1989), how the labor market induces the manager to choose a short-term strategy, even if a long-term strategy with higher expected return is available. I depart from the career concern literature because I analyze the incentives of otherwise identical individuals to acquire skills on the job and not their desire to signal ability. Furthermore, differently from most of the papers on career concerns, my focus is to derive the optimal contract.[8]

The remainder of the paper is organized as follows. Section II describes the model. Section III, IV and V derive the optimal contracts. Section VI endogenizes outside offers. Section VII discusses the main hypotheses and some extensions. Section VIII presents empirical evidence consistent with the model implications. Section IX concludes. All proofs are in the Appendix.

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[8]Two notable exceptions in the career concern literature are Holmström and Ricart-i-Costa (1986) and Narayanan (1996) who study how the form of compensation can improve managerial incentives. While their models also imply that the managerial horizon problem can be mitigated with long-term compensation, they study the optimal contract in a context that is not directly applicable to the current debate on CEO compensation. In particular, they cannot explain the great variety of managerial contracts, the surge in executive compensation, and how the structure of compensation depends on growth opportunities and the managerial labor market.

II The model

A Timing

The timing of events is summarized as follows:

First Period

- At $t = 0$, firm shareholders hire a manager and offer a contract, which can be either long-term or short-term;

- After accepting the contract, the manager observes whether a value-enhancing long-term strategy is available and chooses the strategy's horizon; while implementing the strategy, the manager acquires skills;

- The manager decides whether to exert effort in the first period;

- At $t = 1$, the first-period output is realized. The manager receives her first-period compensation.

Second Period

- If the skills acquired during the first period are useful at other firms, the manager receives an outside offer;

- If the contract signed at $t = 0$ is short-term, the manager is offered a new short-term contract. If the contract offered at $t = 0$ is long-term, depending on her outside options, the manager may propose to renegotiate. The manager can sell unrestricted rights to the second-period output if she owns any. If the manager has received an outside offer, she also decides whether to switch firm;

- The manager decides whether to exert effort in the second period;

- At $t = 2$, the second-period output is realized and the manager receives her second-period compensation.

B   Managers and outside offers

The manager maximizes her expected utility. She is risk-neutral and discounts her future income at rate $\delta \geq 0$. The managerial impatience captures the cost of having managerial wealth tied up in long-term compensation, rather than being able to smooth income intertemporally and plays a role in the analysis only in Section V. The manager's expected utility at $t = 0$ is:

$$(1) \quad E_0(U_0) = E_0(w_1^c - \gamma e_1) + \frac{E_0(w_2^c - \gamma e_2)}{1 + \delta},$$

where w_t^c is the compensation at t, under contract c. Contracts are either long-term (l) or short-term (s). At $t = 0$, the manager selects the firm's strategy. Additionally, at the beginning of each period, the manager chooses whether to exert effort: $e_t \in \{0, 1\}$. Strategy selection and effort provision are not observable.

Effort involves a non-monetary cost: γ. As will be clear later, w_t^c is subordinated to a successful realization of the firm's output. Thus, the manager chooses to exert effort at $t-1$ if $E_{t-1}(w_t^c - \gamma) \geqslant 0$. In what follows, I refer to the latter constraint as effort constraint at $t - 1$.

If at $t = 0$ the effort constraint is not satisfied, the manager does not exert effort and produces no output in the first period, but continues to pursue the selected strategy, and can eventually produce positive output in the second period if she exerts effort; the manager acquires skills in the implementation of the strategy even if she does not spend effort.[9] If at $t = 1$ the effort constraint is not satisfied, no output is produced in the final period.

The income profile of the manager depends on her strategy choice. The strategy matters not only because it affects the firm's output, but also because it determines the type of experience (skills) acquired by the manager during the first period and, therefore, the probability of receiving outside offers. An outside offer consists of a wage W and guarantees a payoff net of effort costs $W - \gamma$. For now, the outside offer is assumed to be set by market forces that remain outside of the model. One may think that other firms, due to exogenous reasons, such as a technological shock or corporate scandals, need a new manager with experience in some specific tasks. In Section VI,

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[9]This implies that, differently from the strategy selection, the decision whether to spend effort in the first period does not depend on the anticipation of the second period payoff. I make this assumption for simplicity's sake. As shown in Subsection VII.B, the results hold without this assumption.

I endogenize outside offers.

C Strategies and firm value

Firm shareholders (henceforth, the firm) are risk neutral and have zero discount rate. Their objective is to maximize the value of the firm, which is equal to the expected cash flows net of the managerial compensation. The value of the firm depends on managerial effort and on the horizon of the strategy (h) chosen by the manager. The strategy may be either long-term (l) or short-term (s): $h \in \{l, s\}$. The horizon of the strategy captures the manager's intentions on the length of her tenure at the current firm and affects the firm's output as well as the type of skills the manager acquires.

The short-term strategy can always be pursued, while the long-term strategy is implementable only with probability ϕ strictly less than 1. Only the manager observes whether a long-term strategy is implementable.[10] The long-term strategy must be thought as a one-time growth opportunity that depends on business cycles, product market, and other non-replicable circumstances. If pursued such a strategy can greatly enhance the expected long-term output of the firm. If disregarded, the strategy is no longer available nor can other long-term strategies be expected to be available.[11]

In the first period, the manager can produce output $x_1 = X$ with probability p, if she exerts effort at $t = 0$, whatever the strategy horizon is. At date 2, a manager who exerts effort and has chosen strategy h can produce high output $x_2 = X$ with probability $p_2^h = h$, if she remains with the current employer. The output is equal to zero otherwise. The long-term strategy is value-enhancing because it is more profitable than the short-term strategy in the long run. The probability of a successful realization of the output with the short- and long-term strategies are such that: $0 < s \leq l \leq 1$. The larger are $l - s$ or ϕ, the stronger are the firm's growth opportunities.

No output is produced at t, if the manager exerts no effort, independently from the strategy choice. Expected cash flows are larger than the manager's effort cost: $sX - \gamma \geq 0$ and $pX - \gamma \geq 0$. Furthermore, the outside offer is more attractive than continuing the short-term strategy at the current employer: $sX \leq W$; but implementing the long-term strategy at the current employer can be more remunerative than the outside offer: $lX > W$.[12]

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[10] Noe and Rebello (2007) develop a dynamic theory of passive boards in a situation in which, similarly to this paper, managerial strategies are not contractible.

[11] This prevents firms from developing a reputation for rewarding managers pursuing long-term strategies.

[12] Neither of these assumptions is essential for the results to hold. These assumptions, however, allow me to

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By pursuing the short-term strategy, the manager acquires skills that are useful at other firms and receives an outside offer with probability ξ. If the manager selects the long-term strategy, the probability of acquiring skills that are useful at other firms and receiving an outside offer is only $\kappa\xi$ where $0 \leq \kappa \leq 1$.[13] The parameter ξ is related to the depth of the managerial labor market. The parameter κ captures how general skills are: Focusing on internal operations, the manager acquires skills that may be useful only within a given industry or for specific tasks, and, for given depth of the managerial labor market, she is less likely to receive outside offers. The payoff of the strategies as well as the probability of an outside offer conditional on the selection of a given strategy are common knowledge.

Finally, I assume that the skills acquired by the manager in the first period are crucial for carrying out the firm's strategy in the second period, and that no output is produced if the manager quits. This specification avoids unnecessary parameters; however, as I discuss in Section III, all that is needed is a sufficiently high cost of managerial turnover.

D   Contracts

Contracts subordinate compensation on output. Strategies, skills, and offers are non contractible for the following reasons. First, the horizon of implementable strategies and the strategy that the manager is pursuing are not observable. Second, while observable at $t = 1$, outside offers and the skills are not contractible at $t = 0$ because they are highly varied and cannot be enumerated in a contract (see, for instance, Malcomson, 1997).

I consider two types of contracts between the manager and the firm: (1) Short-term contracts are signed at date $t = 0$ ($t = 1$) and establish the fraction of the output that the manager receives at the end of the period ($t = 1$ ($t = 2$)); (2) Long-term contracts are signed at $t = 0$ and establish compensation at $t = 1$ *and* $t = 2$.

By offering the manager stocks or stock options at $t = 0$, the firm can credibly make compensation dependent on long-run performance as the manager would not agree to renegotiate if

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concentrate on the most interesting parameter configuration, in which the potential outside offer is attractive enough, but not so attractive to dominate the current employer if the manager is pursuing the long-term strategy. More importantly, they guarantee that pursuing the long-term strategy at the current employer is socially efficient.

[13]The model would have similar implications if the probability of obtaining an outside offer were the same whether the manager pursues the long-term or the short-term strategy, but the manager could obtain a better outside offer (higher W) with the short-term strategy.

this lowers her utility. However, the manager cannot commit to remain with the firm if she gets a better outside offer. This assumption is equivalent to say that human capital is inalienable.[14] At $t = 1$, after the first period output is realized, the manager proposes to renegotiate the contract if she receives a better outside offer. In this case, she does not necessarily leave the firm where she is employed, but can obtain a payment that matches her outside offer in expected value if this is optimal for the firm. In addition, at $t = 1$, the firm can propose a mutually beneficial renegotiation offering to exchange part of the compensation at $t = 2$ for an immediate cash payment.[15]

I assume that the manager has limited liability and therefore can receive only non-negative transfers and focus on linear contracts: $w_t^c = \beta_t^c x_t$, where c is the horizon of the contract and t is the date at which compensation actually accrues to the manager. This spans the entire set of feasable contracts because 1) the output can only take two possible outcomes 2) being risk neutral the manager has the same utility from a fixed payment at time t as for a fraction of the output with equal expected payoff at time t. If $\delta > 0$, however, the manager prefer compensation at time t than at $t+1$. Thus, the model has implications on the timing of compensation, but stocks, options, and other incentive plans achieve identical results.[16]

Finally, I assume that there are more potentially first-time managers than firms.[17] Hence, the optimal contract maximizes firm shareholders' payoff subject to the manager's incentive and participation constraints.

III   Short-term contracts

With a short-term contract, compensation can be interpreted as consisting of a bonus, but no stocks as the manager is not awarded a share of the second period output at $t = 0$. Even so, the manager internalizes that the selected strategy affects her second-period remuneration. Since both strategies have the same expected output in the first period (I relax this assumption in Subsection VII.A),

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[14]This assumption requiring that the manager cannot commit to slavery is a realistic representation of the labor market, similar to Hart and Moore (1994).

[15]It would be equivalent if at $t = 0$ the firm offered the manager to choose at $t = 1$ between two contracts involving either a share of the output at $t = 2$ or an immediate cash payment plus some share of the output at $t = 2$.

[16]I also do not explicitly consider non-compete clauses. To the extent that these may at most prevent the manager from taking jobs in firms with closely related businesses, however, they may even accentuate managerial incentives to acquire general skills.

[17]It is irrelevant whether the manager is hired from outside or inside the firm if this does not affect the probability of receiving an outside offer.

the strategy's choice depends crucially on the manager's expectations on the contract offered by the firm in the second period.[18] The firm offers the second-period compensation to the manager after observing whether she has received an outside offer; the firm does not observe which strategy the manager has selected nor whether a long-term strategy was ever available.

Consider the state of the world in which the manager has no outside offer and assume that at $t = 0$, the manager undertakes the long-term strategy when available. At $t = 1$, the firm offers either a share of the output for which the manager's effort constraint is satisfied only when she is implementing the long-term strategy or a share of the output for which the manager's effort constraint is satisfied also when she is implementing the short-term strategy.

The effort constraint of the manager that is implementing the short-term strategy is satisfied at $t = 1$ if $\beta_2^s \geqslant \frac{\gamma}{sX}$. If this constraint is satisfied and the manager is implementing the short-term strategy, she remains with the firm and exerts effort. For $\beta_2^s \geqslant \frac{\gamma}{sX}$, the effort constraint is not binding if the manager is pursuing the long-term strategy. Hence, if the firm aims to retain the manager in all states of the world, it offers $\beta_2^s = \frac{\gamma}{sX}$ (any larger value would decrease the firm's payoff without affecting managerial incentives). If the manager spends effort in all states of the world, the firm's expected payoff is: $(1 - \phi)\left(1 - \frac{\gamma}{sX}\right) sX + \phi\left(1 - \frac{\gamma}{sX}\right) lX$ as the output depends on whether a long-term strategy is available (with probability ϕ). Since because of limited liability, at $t = 0$, the manager can receive only non-negative transfers from the firm, she enjoys an informational rent when she is pursuing the long-term strategy.

If the firm aims to satisfy the manager effort constraint only if she is implementing the long-term strategy, it offers $\beta_2^s = \frac{\gamma}{lX}$.[19] If the manager is pursuing the short-term strategy, her effort constraint is not satisfied: The manager perceives no informational rent, but no output is produced in the second period. Thus, in equilibrium, output is produced with probability ϕ and the firm's expected payoff is: $\phi\left(1 - \frac{\gamma}{lX}\right) lX$.

Hence, in the state of the world in which the manager has no outside offer, the firm finds it optimal to satisfy the effort constraint when the manager pursues a short-term strategy and offers $\beta_2^s = \frac{\gamma}{sX}$ if this guarantees a higher expected payoff:

$$(1 - \phi)\left(1 - \frac{\gamma}{sX}\right) sX + \phi\left(1 - \frac{\gamma}{sX}\right) lX \geqslant \phi\left(1 - \frac{\gamma}{lX}\right) lX,$$

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which implies:

$$(2) \quad \phi \left(sX - \gamma + \gamma \left(\frac{lX}{sX} - 1 \right) \right) \leqslant sX - \gamma.$$

Condition (2) compares the expected gain from appropriating a larger share of the long-term strategy's output (right-hand side) with the expected output loss caused by the manager's underprovision of effort (left-hand side). The latter is larger if the long-term strategy is rarely available (ϕ low), while the expected gain from a larger share of the long-term strategy's output is smaller if the long-term strategy is rarely available or if its expected output (lX) is not much larger than for the short-term strategy (sX). Thus, condition (2) is satisfied if growth opportunities are sufficiently low. In this case, the firm has an incentive to share some of the surplus of the long-term strategy with the manager, even after the strategy's selection.

In the state of the world in which the manager receives an outside offer, under my assumptions on project payoffs, the firm can retain the manager at $t = 1$ only if she is pursuing the long-term strategy by offering $\beta_2^s = \frac{W}{lX}$. Hence, if the manager has an outside offer, the firm offers $\beta_2^s = \frac{W}{lX}$. In equilibrium, the manager quits unless she is pursuing the long-term strategy.

Now, consider the manager's optimal response at $t = 0$. In particular, I need to establish under which conditions the manager indeed finds it optimal to pursue the long-term strategy if available. If condition (2) is not satisfied, in equilibrium, the manager does not expect to be compensated for undertaking the long-term strategy and may select the self-enhancing short-term strategy in order to increase her chances of getting an outside offer. The manager may have an incentive to choose the long-term strategy only if condition (2) is satisfied and the firm is expected to offer $\beta_2^s = \frac{\gamma}{sX}$ at $t = 1$, when the manager has no outside offer. In this case, at $t = 0$, the manager actually finds it optimal to pursue the long-term strategy when available if:

$$(3) \quad (1 - \kappa\xi) \left(\frac{\gamma}{sX} lX - \gamma \right) + \kappa\xi \left(W - \gamma \right) \geqslant \xi \left(W - \gamma \right).$$

The left-hand side is the expected payoff of the long-term strategy. It takes into account that the manager receives an outside offer with probability $\kappa\xi$. In this case, the initial firm offers the manager $\beta_2^s = \frac{W}{lX}$. The right-hand side represents the expected payoff of the short-term strategy. In this case, with probability ξ, the manager receives an outside offer and quits; otherwise, her

expected payoff is zero as the compensation offered by the initial firm is equal to the effort cost in expectation.

When condition (2) is satisfied, the manager has an incentive to undertake the long-term strategy only if outside job opportunities are expected to be limited, as required by condition (3). Condition (3) is always satisfied if the wage offered by a potential new employer is sufficiently low $\left(W < \frac{\gamma}{sX} lX \right)$. More in general, it is easy to prove that the condition poses an upper bound on the probability of an outside offer, ξ. This implies that if the managerial labor market is deep, a manager rewarded only with short-term compensation chooses to forgo growth opportunities in order to enhance the probability of receiving outside offers. Incentives to do so are stronger if outside options are attractive in comparison to the current employment (W large).

The following proposition summarizes the conditions under which the manager pursues the value-enhancing long-term strategy with short-term compensation. This is the case if conditions (2) and (3) are satisfied.

Proposition 1 *If growth opportunities are relatively rare (ϕ low), and the managerial labor market is relatively thin (ξ low) or outside options not very attractive (W low), the manager pursues the value-enhancing long-term strategy with a short-term contract.*

The intuition behind Proposition 1 is the following: When growth opportunities are relatively rare, the firm finds it optimal to behave as if such opportunities did not exist. Thus, when an opportunity appear the manager can enjoy an informational rent and is more likely to pursue it. Interestingly, a decrease in the payoff of growth opportunities (lX) has less clear-cut implications on the equilibrium. Although it also makes the firm behave as if the growth opportunities did not exist, it also weakens the manager's incentives to pursue the long-term strategy.

Proposition 1 is derived under the assumption that the firm cannot continue the project with a new manager. However, all what is needed is that the manager is essential for continuing the selected long-term strategy. Results are qualitatively invariant if the firm can obtain the payoff of the short-term strategy with a new manager and there are costs of managerial turnover, which affect the firm's payoff.

The following proposition describes the equilibrium strategies when conditions (2) and/or (3) are not satisfied.

Proposition 2 *If the managerial labor market is deep (condition (3) is not satisfied), there exists a pure-strategy equilibrium in which the manager always selects the self-enhancing short-term strategy and the firm always offers $\beta_2^s = \frac{\gamma}{sX}$ at $t = 1$ when the manager has no outside offer.*

If there are strong growth opportunities (condition (2) is not satisfied), but the managerial labor market is thin (condition (3) holds), there is no pure strategy equilibrium; There exists a mixed strategy equilibrium in which:

- *The manager selects the value-enhancing long-term strategy with probability*

$$\frac{\left(1 - \frac{\gamma}{sX}\right) sX}{\phi\left(\left(1 - \frac{\gamma}{lX}\right) lX + \left(1 - \frac{\gamma}{sX}\right) sX - \left(1 - \frac{\gamma}{sX}\right) lX\right)},$$

  which decreases in ϕ and l;

- *When the manager has no outside offer, the firm offers $\beta_2^s = \frac{\gamma}{sX}$ with probability $\frac{\xi(1-\kappa)(W-\gamma)}{(1-\xi\kappa)\left(\frac{\gamma}{sX}lX-\gamma\right)}$ and $\beta_2^s = \frac{\gamma}{lX}$ with probability $1 - \frac{\xi(1-\kappa)(W-\gamma)}{(1-\xi\kappa)\left(\frac{\gamma}{sX}lX-\gamma\right)}$.*

Proposition 2 implies that short-term compensation leads to relatively less efficient investment choices when managers are more likely to obtain rich outside offers and as growth opportunities improve. If the managerial labor market is deep, the manager need a fraction of the second period output larger than $\frac{\gamma}{sX}$ to pursue the growth opportunities. The firm, however, cannot commit to that in absence of an outside offer and the manager rationally chooses to acquire general skills.

Growth opportunities exacerbate the conflict of interest between the manager and the firm. When condition (2) is not satisfied, but condition (3) is, the ex post opportunistic behavior of the firm resembles the *ratchet effect* (see Bolton and Dewatripont, 2004, p. 368): The firm offers a tougher contract in the intermediate period to the manager because it expects her productivity to be high. The ex post unilateral gain of the firm turns out to be detrimental from an ex ante point of view, because it is anticipated by the manager. Nonetheless, with the short-term contract, if condition (2) is not satisfied, the firm cannot even commit to offer $\frac{\gamma}{sX}$ in the second period. In the next section, I explore to what extent the long-term contract, providing this commitment, can enhance firm value.

IV Long-term contracts

This section studies under what conditions long-term contracts mitigate the double moral hazard problem leading to inefficient strategy selection and too little acquisition of firm-specific skills. Put differently, I ask when the firm finds it optimal to commit to award the manager a share of the second-period output larger than what it could credibly pay with short-term contracting. To simplify the exposition, in this section, I assume that the manager is not impatient ($\delta = 0$). I relax this assumption in Section V.

The following considerations help to simplify the problem. The share of the first period output that the firm offers to the manager is at most $\frac{\gamma}{pX}$. The firm would never have an incentive to offer $\beta_1^l > \frac{\gamma}{pX}$ as this would not increase output or make the strategy choice more efficient. In addition, it is always optimal for the firm to stimulate effort in the first period. Thus, an optimal long-term contract is such that $\beta_1^l = \frac{\gamma}{pX}$. Also notice that since the realization of the first period output is not informative about the strategy choice, the contracting problem can be reduced to the choice of the share of the second period output to be awarded to the manager.

Based on these considerations, I can focus on how at $t = 0$ the firm chooses β_2^l. In what follows, I analyze this reduced problem. I focus on instances in which the long-term contract provides a commitment device to award the manager a share of the second period output larger than the one the firm could credibly pay with short-term contracting. Clearly, when this commitment is not valuable, the firm can always replicate the outcome of the short-term contract with a long-term contract. Thus, in this respect, the long-term contract is always optimal.

When it does not simply replicate the short-term contract, the long-term contract can have two different structures. The intuition is the following: Since only non-negative transfers to the manager are allowed, the long-term contract may involve a rent for the manager if no long-term strategy is available. In order to reduce the informational rent, the firm may choose not to satisfy the manager's effort constraint in the second period if only the short-term strategy is available. This reduces the managerial rent, but involves an output loss due to the manager's underprovision of effort. The firm optimally chooses the least of these two costs. Under certain parameter configurations, in equilibrium, managerial turnover in anticipation of weak performance arises, while in others managers enjoy rents. Below I consider the two contract structures in turn. In Section IV.C, I determine which one is optimal. Finally, in Section IV.D, I establish under what conditions the

commitment associated to the long-term contract increases the firm's value.

A Long-term contracts with managerial rents

Here, I derive the optimal contract when at $t = 0$ the firm finds it optimal to satisfy the manager's effort constraint if she is pursuing the short-term strategy. A long-term contract maximizes the firm's expected cash flows net of managerial compensation:

$$\max_{0 \leq \beta_2^l \leq 1} \phi \left(\left(1 - \beta_2^l\right) lX - \max\left\{W - \beta_2^l lX, 0\right\} \xi\kappa \right) + (1 - \phi)(1 - \xi)\left(1 - \beta_2^l\right) sX.$$

The firm's expected payoff is written under the assumption that the manager undertakes the long-term strategy if this is available as, if this were not the case, the firm could replicate the outcome of the long-term contract with the short-term contract. The first term in the expected payoff of the firm captures that, with probability ϕ, a growth opportunity is available; the firm's share of the second-period output may be reduced if the manager receives an outside offer (with probability $\xi\kappa$) and negotiates an extra payment $\max\left\{W - \beta_2^l lX, 0\right\}$; with probability $1 - \phi$, no growth opportunity is available and the manager remains with the firm only if she receives no outside offer (with probability $1 - \xi$).

The firm expected payoff is maximized subject to the following effort constraints of the manager:

(EFS) $\beta_2^l sX - \gamma \geq 0$,

(EFL) $\beta_2^l lX - \gamma \geq 0$;

and the manager's strategy constraint to be satisfied at $t = 0$:

(ST) $\beta_2^l lX + \xi\kappa \max\left\{W - \beta_2^l lX, 0\right\} \geq \xi W + (1 - \xi)\beta_2^l sX.$

The two effort constraints (EFS) and (EFL) are identical to the ones that the firm faces with short-term contracting. The long-term contract also involves the strategy constraint (ST). Constraint (ST) requires that at $t = 0$ the manager's expected payoff from pursuing the long-term strategy (left-hand side) is larger than the expected payoff from the short-term strategy (right-hand side). The left-hand side of (ST) recognizes that with probability $\xi\kappa$ the manager receives an

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outside offer when she is pursuing the long-term strategy. Since the first period expected output and therefore the first period compensation are equal under the two strategies, only the second-period payoffs are compared in (ST).

I can simplify constraint (ST) by proving that the renegotiation payoff is always $W - \beta_2^l lX > 0$ if the constraint is binding. In other words, the firm never commits to pay more than the potential outside offer. Therefore, the long-term contract is always renegotiated if an outside offer arrives. This is established in Lemma 1.

Lemma 1 *If the strategy constraint is binding, the optimal long-term contract is renegotiated after an outside offer. With probability ξ, at $t = 1$, the manager receives a lump-sum payment: $W - \beta_2^l lX$.*

It follows from Lemma 1 that constraint (ST) can be rewritten as follows:

(ST') $\xi \kappa W + (1 - \xi \kappa)\beta_2^l lX \geq \xi W + (1 - \xi)\beta_2^l sX.$

The solution for the optimal contract can be further simplified by noting that (EFL) is not binding if (EFS) or (ST') are satisfied. Thus, either (EFS) or (ST') are binding. The solution is now straightforward.

Proposition 3 *An optimal long-term contract which the manager's effort constraint if she is pursuing the short-term strategy is such that:*

- *If ξ and W are relatively low (condition (3) holds), the strategy constraint (ST) is not binding and $\beta_2^l = \frac{\gamma}{sX}$.*

- *If ξ and W are relatively high (condition (3) does not hold), the strategy constraint (ST) is binding and $\beta_2^l = \frac{\xi W(1-\kappa)}{(1-\xi\kappa)lX - (1-\xi)sX}$.*

If the strategy constraint is not binding, the long-term contract can be regarded as a commitment device for the firm. When ϕ is large (condition (2) does not hold), without a long-term contract, the firm has an incentive to behave opportunistically ex post. The firm's commitment to share the surplus gives the manager incentives to choose the value-enhancing long-term strategy. At $t = 0$, it is optimal for the firm to commit to grant a share of the second-period cash flow because this increases the expected output.

The strategy constraint is binding if managers are likely to receive outside offers (ξ high) or if outside offers are attractive (W high). When this is the case, the second-period effort constraints (EFS) and (EFL) are slack. Thus, the manager enjoys an informational rent if the long-term strategy is not available.

Corollary 1 *If the strategy constraint is binding, in a long-term contract, managerial compensation is increasing in the probability of receiving an outside offer, ξ, and the attractiveness of the outside offer, W.*

The cost of using long-term contracts is increasing in the depth of the managerial labor market, as at $t = 0$, if ξ and/or W are larger, the firm needs to offer a larger share of the second-period output to the manager. Furthermore, Lemma 1 implies that as ξ increases these highly paid managers are more likely to be awarded windfall payments with no justification in terms of past performance because the strategy constraint is binding; these windfall payments (i.e., the renegotiation payoff accruing after an outside offer) increase in W. Since declined outside offers are unlikely to be publicly observable, these payments appear pure rent extraction by the manager. However, they are optimal because they allow the manager to continue the long-term strategy that may lead to high project output in the future. Moreover, these payments contingent to outside offers allow the firm to "screen-out" managers that were unable to pursue long-term strategies as they always quit. Thus, payments contingent to outside offers decrease the manager's informational rent.

B Long-term contracts with underprovision of effort

Here, I consider long-term contracts in which the firm does not find it optimal to satisfy the manager's effort constraint (EFS). As in Subsection IV.A, the problem can be simplified by noting that Lemma 1 holds. Thus, the optimal contract satisfies the following program:

$$\max_{0 \leq \beta_2^l \leq 1} \phi \left(\left(1 - \beta_2^l \right) lX(1 - \xi\kappa) + W\xi\kappa \right)$$

subject to the effort constraint (EFL) and the strategy constraint that is now written as

(IC") $(1 - \kappa\xi)\beta_2^l lX + \kappa\xi W - \gamma \geq \xi (W - \gamma)$.

The effort constraint (EFL) is always slack and can be ignored. Thus, the determination of the optimal contract is now straightforward.

Proposition 4 *An optimal long term contract with underprovision of effort if the manager is pursuing the short-term strategy exists only if lX is sufficiently large and is such that:*

$\beta_2^l = \frac{\xi(1-\kappa)}{1-\xi\kappa} \frac{W-\gamma}{lX} + \frac{\gamma}{lX}.$

Also in this case managerial compensation is increasing in the probability of receiving an outside offer, ξ, and the attractiveness of the outside offer, W.

Note that also in this case the long-term contract allows the firm to commit to pay a share of the output larger than what it would with short-term contracting as if (2) does not hold the firm has an incentive to offer $\frac{\gamma}{lX}$. If lX is sufficiently large (i.e., when a long-term contract with underprovision of effort may emerge in equilibrium), not satisfying the effort constraint when the manager is pursuing the short-term strategy allows the firm to eliminate the managerial informational rent. In the next subsection, I establish under what conditions this benefit prevails over the expected output loss due to the underprovision of effort.

C Long-term contracts, effort provision, and managerial rents

So far, I have shown that the firm's commitment to long-term compensation may take two different structures. Below I determine when either of the two is optimal.

Proposition 5 *In firms with high growth opportunities (ϕ and lX large), the manager never provides effort in the second period if the short-term strategy is available.*

The expected output loss due to underprovision of effort is smaller than the benefit of eliminating the managerial rent, if the long-term strategy is very likely to be available as the inefficiency due to the manager's underprovision of effort is unlikely to occur. Also, if lX is large, it is possible to give incentives to the manager to pursue the long-term strategy by granting a relatively low share of the output. Satisfying her effort constraint when only the short-term strategy is available requires stronger incentives and an expected payment at $t = 2$, which is increasing in lX. For weak growth opportunities, it is optimal to offer a second-period compensation package that satisfy the effort constraint if the manager is pursuing the short-term strategy.

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When at $t = 1$ the effort constraint is not satisfied, no output is produced in the final period. Since the manager payoff from remaining employed in the firm is zero, the manager may be thought to quit. Following this interpretation, the structure of the long-term contract is such that even managers without outside offers voluntarily quit in anticipation of disappointing future performance, especially in firms with strong growth opportunities.[20]

D   When is the long-term commitment valuable?

Here I determine under which conditions committing to higher compensation through a long-term contract is optimal for the firm.

Proposition 6 *Committing to higher long-term compensation increases the firm's value if the manager's strategy constraint is not binding (condition (3) holds). If the manager's strategy constraint is binding, the commitment maximizes the firm's value net of managerial compensation if growth opportunities are relatively strong (ϕ large).*

When the strategy constraint is binding, the long-term contract is costly for the firm. The expected cost is higher, the weaker the firm's growth opportunities (ϕ) are. Hence, short-term contracts are optimal, and, in equilibrium, growth opportunities are not pursued if the managerial labor market is deep. As growth opportunities improve, the expected benefit of the long-term commitment prevails on the expected cost of the informational rent (or, for even larger growth opportunities, on the expected cost of underprovision of effort) because the expected increase in output that it allows is even larger. This effect is consistent with empirical evidence showing that firms experience positive abnormal returns upon the announcement of compensation plans that link pay to stock prices or that introduce long-term incentive pay (Morgan and Poulsen, 2001). Even for a relatively low β_2^l, the long-term commitment is associated to larger payouts to the manager, because the output increases.

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[20]Note that the firm cannot reduce the cost of the long-term contract by attempting to elicit the manager's private information at $t = 1$ using cash payments. In fact, if the manager is patient ($\delta = 0$), she is indifferent between a cash payment at $t = 1$ and a share of output with the same expected payoff at $t = 2$. The manager would always have an incentive to lie (and could do so without being refuted) to increase her compensation: In particular, when the long-term contract is such that it is optimal to satisfy the effort constraint when the long-term strategy is not available, even if the manager admitted that no long-term strategy is available, she would not accept to renegotiate for a lower expected payment and would keep the rent. When the long-term contract is such that it is optimal not to satisfy the effort constraint when only the short-term strategy is available, the manager would always claim that no long-term strategy is available to be given incentives to produce in the second period and to obtain a higher share of the second-period output.

Since outside offers capture the demand for experienced CEOs, one may argue that the increase in managerial compensation is explained by an increase in demand for experienced CEOs, as, for instance, in Murphy and Zabojnik (2007). However, my model generates richer empirical implications. First, more generous compensation packages are associated to higher long-term compensation and payments unrelated to past performance. A mere increase in the demand for experienced CEOs could not explain the changes in the structure of pay. Second, if CEOs have more attractive outside options, there is a larger variation in managerial contracts and in the level of compensation across firms. On the one hand, the managers of firms with low growth opportunities receive moderate compensation packages and their remuneration is more likely to be only short-term. On the other hand, at firms with strong growth opportunities, there is a surge in the level of managerial compensation and a larger proportion of it depends on long-term performance. Thus, identical managers receive low compensation in some firms and high compensation in others.

V Can Short Vesting Periods Ever Be Optimal?

In Section IV, I assume that at $t = 0$ the manager can only be awarded rights to the second-period output that cannot be transferred in the intermediate period. This is without loss of generality because the manager is assumed to be patient and the timing of compensation can affect incentives, but not the utility from a given payment. Here, I allow the manager to be impatient ($\delta > 0$) and study whether conferring the manager rights to the second-period output that can be sold in the intermediate period can ever be optimal. I sometimes refer to the rights to the second-period output that cannot (can) be transferred in the intermediate period as restricted (unrestricted) stocks, even though any other type of long-term non-transferable (transferable) compensation would be equivalent in the model. I denote with β_2^{tl} the right to enjoy the corresponding share of second-period cash-flows that can be transferred at time t. Hence, $\beta_2^{1l} > 0$ indicates that the manager is awarded unrestricted stocks, while β_2^{2l} must be interpreted like the restricted stocks in the previous subsection (the share of the output that can be transferred only after it is realized).

I consider two cases. First, I allow the manager to transfer the rights to the second-period output only to the firm and describe how this arrangement can be implemented.[21] Second, I allow

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[21] It would be equivalent if the firm did not announce at $t = 0$ what proportion of the rights to the second period output it is willing to repurchase as β_2^{1l} is the equal to the optimal amount that the firm would be willing to repurchase

the manager to sell the rights to the second-period output in the stock market and show that the conditions under which the second arrangement is dominated by the first.

I consider an equilibrium in which the manager finds it optimal to sell unrestricted rights to the second-period output only if she has undertaken the short-term strategy. It will be clear later that this can be the only equilibrium. A necessary condition for unrestricted rights to the second-period output to affect the optimal contract in a non-trivial way is that at $t = 1$, in some states of the world, the manager is willing to transfer them and can obtain a positive price. Under my assumptions, when the manager sells, the firm has positive value only if the manager spends effort in the second period when she is pursuing the short-term strategy. If the manager is expected to never spend effort after selling, any rights to the second-period output are worthless at $t = 1$ and for the firm (or any market participant) it would be rational to pay zero in the renegotiation. Thus, in equilibrium, unrestricted rights would give the manager exactly the same payoff of restricted rights and the contract would be identical to the one in Section IV. The following Lemma derives conditions under which β_2^{1l} can be sold to the firm at a positive price.

Lemma 2 *In the optimal contract, $\beta_2^{2l} \geq \frac{\gamma}{sX}$ if $\beta_2^{1l} > 0$.*

Lemma 2 implies that unrestricted stocks should always be granted with some restricted stocks, which ensure that the manager spends effort in the second period, even if she is pursuing the short-term strategy. Thus, unrestricted stocks can only be optimal if the manager's strategy constraint is binding and we should observe grants of unrestricted stocks (or options) for managers with high compensation, which also receive restricted stocks (or options).

At $t = 1$, after having observed whether the manager has an outside offer, the firm offers to repurchase β_2^{1l} unrestricted rights to the second-period output at a price to be determined below and that weakly increases both the manager's and the firm's payoffs.[22] If the condition in Lemma 2 is satisfied, after having observed that the manager has no outside offer, it is optimal for the firm to make a take-it-or-leave-it offer to purchase β_2^{1l} at price $\frac{sX}{1+\delta}$. At this price, if the manager is pursuing the short-term strategy, she is indifferent between selling and receiving immediately $\beta_2^{1l} \frac{sX}{1+\delta}$ or not selling and obtaining $\beta_2^{1l} sX$ at $t = 2$. Owning to managerial impatience, the renegotiation

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ex post. This way of presenting the analysis facilitates the comparison with the other arrangements discussed below.

[22]Note that since this equilibrium considers a mutually beneficial renegotiation for the manager and the firm, β_2^{1l}, does not have to be necessarily determined at $t = 0$, but could be similarly derived as the expost optimal share of stocks that the firm finds optimal to repurchase at $t = 1$.

is beneficial for the firm: If the manager sells only when she is pursuing the short-term strategy, the renegotiation does not affect the value of the second-period expected output and it allows to repurchase the rights to the second-period output at a discount, $\frac{\delta}{1+\delta}sX$.

When the manager is pursuing the long-term strategy, she faces a trade off in deciding whether to sell. On the one hand, she has an incentive to sell because she is impatient ($\delta > 0$). On the other hand, only the manager observes whether she is pursuing the long-term strategy and she has to sell at a discount if she is doing so. The following lemma establishes that in a long-term contract $\beta_2^{1l} > 0$ may be optimal only if the manager does not have an incentive to sell the rights to the second-period output when she has favorable private information (she knows that she is pursuing the long-term strategy).

Lemma 3 *A necessary condition for the optimality of $\beta_2^{1l} > 0$ is that $\frac{lX}{1+\delta} > sX$.*

Unrestricted rights to the second-period output affect the managerial strategy constraint only if the manager finds it optimal not to transfer them in at least some states of the world. Otherwise, they are similar to a cash transfer not subordinated to performance and can never be optimal because they do not affect managerial incentives. Thus, the manager's willingness to sell the rights to the second-period output reveals to the firm that the manager has undertaken the short-term strategy. By offering to purchase any "excess" incentives, the firm benefits from managerial impatience, when the manager is pursuing the short-term strategy. Thus, it is optimal for the firm to purchase as many stocks as possible without interphering with effort provision.

Proposition 7 *If the manager is impatient, a firm with intermediate levels of growth opportunities (ϕ and lX) offers $\beta_2^{1l} = \frac{\xi W(1-\kappa) + \gamma(1-\xi) - \gamma(1-\xi)\kappa \frac{lX}{sX}}{(1-\xi\kappa)lX - (1-\xi)sX}$ and $\beta_2^{2l} = \frac{\gamma}{sX}$. A firm with high growth opportunities offers only restricted stocks as in Proposition 5 and no output is produced in the second period if the manager pursues the short-term strategy. Finally, committing to long-term compensation does not increase the firm's value net of managerial compensation if growth opportunities are relatively small (ϕ small).*

The contract described in Proposition 7 leaves the managerial rent unchanged with respect to the contract described in Subsection IV.A. However, since here the manager is assumed to be impatient, by anticipating managerial income in some states of the world, the firm can provide

incentives and the managerial rent more efficiently. This increases the social surplus. This ex post Pareto-improving renegotiation is similar to Axelson and Baliga (2009). However, while Axelson and Baliga argue that ex post incentives to renegotiate may undermine ex ante optimal long-term contracts, I show that unrestricted stocks may be a component of the long-term contract even if there are retention problems.

Albeit with larger surplus, the optimal long-term contract still involves a rent. For some parameter configurations, leaving the manager a rent in order to induce her to undertake the value-enhancing long-term strategy is too costly. Thus, underprovision of effort or inefficient strategy selection emerge in equilibrium for high and low levels of growth opportunities, respectively, as described in Proposition 5 and Proposition 6.

The contract with purchases of unrestricted rights to the second-period output by the firm could be implemented with a contract signed at $t = 0$ in which the firm commits to offer the manager at $t = 1$ the following menu of contracts:

1. $\beta_2^{2l} = \frac{\xi W(1-\kappa)}{(1-\xi\kappa)lX-(1-\xi)sX}$ at $t = 2$; or

2. $\beta_2^{2l} = \frac{\gamma}{sX}$ at $t = 2$ plus a cash payment $C_1 = \frac{\xi W(1-\kappa)+\gamma(1-\xi)-\gamma(1-\xi)\kappa\frac{lX}{sX}}{(1-\xi\kappa)lX-(1-\xi)sX} \frac{sX}{1+\delta}$ at $t = 1$.

Manager would self-select and accept the first (second) alternative, depending on whether they are pursuing the long- (short-) term strategy.

While the two arrangements described above may not be often observed in the real world, exactly the same payoffs may be replicated by granting the manager options with short vesting periods, a widespread pay practice. In particular, these payments could be implemented at $t = 0$ with a contract involving a mix of stock options that vest at $t = 1$ and restricted stocks. The amount of restricted stocks to be held until $t = 2$ is: $\beta_2^{2l} = \frac{\gamma}{sX}$. The amount of stock option, SO, and the strike price, SP, are determined in such a way to replicate the payments described in Proposition 7 and in the menu of contracts as follows:

1. For a manager that chooses to exercize the stock options at $t = 2$ (because she is pursuing the long-term strategy), SO and SP should be such that:

$$SO(lX - SP) = \left(\frac{\xi W(1-\kappa)}{(1-\xi\kappa)lX-(1-\xi)sX} - \frac{\gamma}{sX}\right)lX;$$

2. For a manager that chooses to exercize the stock options at $t = 1$ (because she is pursuing the long-term strategy), SO and SP should be such that:

$$SO\left(sX - SP\right) = \left(\frac{\xi W(1 - \kappa)}{(1 - \xi\kappa)lX - (1 - \xi)sX} - \frac{\gamma}{sX}\right)\frac{sX}{1 + \delta}.$$

It is immediate to solve the above system of two equations in two unknowns, which yields $SO^* > \beta_2^{1l}$ in Proposition 7 and $SP^* > 0$.

With either interpretation, the model implies that in equilibrium the managers of firms that underperform in the future receive higher current compensation. This might be interpreted as managerial power and an indication that compensation does not reflect managerial contribution to firm performance. My model highlights that this may be a more efficient way of giving managers incentives to take a long-term view on their tenure at the firm.

My model gives an explanation alternative to Bolton, Scheinkman and Xiong (2006) for why it may be optimal to let managers cash out stocks or options. In Bolton, Scheinkman and Xiong (2006), shareholders give the manager an incentive to inflate the stock price in the short-term to be able to sell overvalued stocks to other market participants with over-optimistic expectations. I show that shareholders may find short vesting periods optimal also when they want to give the manager incentives to undertake value-enhancing long-term corporate strategies. This in turn contrasts with the theoretical result of Edmans, Gabaix, Dadzik and Sannikov (2010) who show that a dynamic incentive account with restriction on current pay is necessary to deter short-termist incentives. The crucial difference is that a one-time strategy choice, not an effort choice that reiterates unchanged over time, is at the hearth of the incentive problem I consider. The strategy selection requires strong incentives only if growth opportunities are available. Incentives are too strong if growth opportunities cannot be pursued. To the extent that short vesting periods allow to undo incentives only in states of the world in which these are too strong, early payouts to the manager allow to increase shareholder returns.

Even though it may be optimal to substitute long-term performance related compensation with immediate cash payments, the model implies that incentives must be carefully designed: Allowing the manager to undo long-term incentives by selling unrestrited rights to second-period output in

the open market is dominated by an arrangement in which unrestricted rights to second-period output can only be purchased by the firm.

Corollary 2 *If market participants are patient and risk neutral, it is not optimal to allow the manager to sell unrestricted rights to second-period output in the open market.*

In this case, when the manager sells the rights to the second-period output in the intermediate period, she receives a price that depends on outside investors' expectations on the future output of the firm. If outside atomistic investors cannot exploit managerial impatience, they offer to pay a higher price than the firm for the unrestricted rights to the second-period output. This requires stronger incentives to meet the strategy constraint. Also, contrary to the firm, it seems plausible that outside investors do not observe whether the manager has an outside offer, but they have rational expectations on the manager's equilibrium strategy. Thus, the manager is able to sell her rights to the second-period output when she receives an outside offer. From the firm's point of view, this has a beneficial effect as it increases the discount at which outside investors purchase shares from the manager[23] and improves the manager's outside option when she obtains an outside offer and is pursuing the long-term strategy, as the manager can threaten to sell the stocks. The latter effect allows to transfer compensation to the state of the world in which the long-term strategy is available. Corollary 2, however, shows that this potential benefit is never large enough to compensate the higher price paid by the market for the inability of exploiting managerial impatience.

Only if for reasons that remain outside the model the market were to apply a larger discount than the firm to managerial sales, allowing to sell unrestricted rights to second-period output in the open market may be optimal, especially if lX is relatively high because the firm would be able to offer the manager a lower share of second period output.

VI Endogenous outside offers

The model relies on an asymmetry between the first employer and potential new employers. While the actual employer values firm-specific skills, potential employers value general skills. This assump-

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[23]This is fully compensated by the fact that the firm does not purchase unrestricted rights to the second period output when the manager has an outside offer.

tion is common in the literature on human capital investment (Becker, 1993). The assumption is also consistent with empirical evidence showing that, while high-tech firms, possibly being new entrants and lacking internal managerial skills, hire CEOs with previous experience in many different industries, other firms value industry experience (Cremers and Grinstein, 2008). The first employer in the model resembles firms that value industry experience and may thus favor investment in firm-specific skills, but also high-tech firms that, after having secured a CEO, may favor the acquisition of firm-specific skills.

While the asymmetry between current and potential employers is justifiable on the ground of existing theories and empirical evidence, it is not at all crucial for the results to hold. Below, I present a simple extension of the model, in which outside offers arise even though current and new potential employers are ex ante symmetric.

Assume that there are N identical firms, in which the strategies I describe above can be pursued if everything is business as usual (with probability $1 - \varsigma$). However, now firms may experience a technological shock with probability ς. Such a shock makes the current CEO's skills obsolete at any firm, whether the long-term or the short-term strategy is being pursued. In other words, with probability ς, at $t = 1$, before the CEO exerts the second-period effort, her career ends. Such a shock does not affect the contracting problem as it has no effect on the relative payoff of short-term and long-term strategies.[24]

The shock generates demand for an experienced CEO with particular skills, which may include experience with new equity issues or identifying new suppliers. There are M heterogeneous skills and a CEO with the right skill can produce surplus W at the company affected by the shock. Conditionally to not experiencing the shock, the skills of the managers pursuing the long-term strategy are attractive with probability $\varkappa \frac{1}{M}$, while the more general skills of the manager pursuing the short term-strategy are attractive with probability $(1 - \varkappa) \frac{1}{M}$, where $\varkappa < \frac{1}{2}$. In terms of the previous parametrization, this implies that $\xi \equiv (1 - \varkappa) \frac{1}{M}$ and $\kappa \equiv \frac{\varkappa}{1 - \varkappa}$.

Abstracting from the integer problem, there are at most $\frac{(1-\varsigma)N}{M}$ experienced managers that acquired the right skill on the job and ςN firms looking for managers with this particular skill. Thus, if $\varsigma N > \frac{(1-\varsigma)N}{M}$, firms hit by the shock compete for the managers and offer all the surplus W.

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[24]Indeed, any payoff is identical to the payoffs P I derived so far, up to a linear transformation: $(1 - \varsigma) P + \varsigma Payoff\_if\_shock$. Thus, none of the derivations changes.

VII   Extensions and robustness

For tractability, I have imposed several simplifying assumptions that are not crucial for my findings. I now discuss the general implications if some of these assumptions are relaxed.

A   Managerial ability and differences in first-period output

In the model, all managers are identical but acquire heterogeneous skills on the job. In addition, the first-period output is not affected by the managerial strategy choice. It may appear more realistic to assume that the first period expected cash flow is higher if the manager is pursuing a short-term strategy because there is less long-term investment. Moreover, the manager's outside offers could depend on the realization of the first period output if this were a signal of managerial ability.

My assumptions appear more appropriate if one considers that CEOs are often able to fake good results in the short-term (Kedia and Philippon, 2009). Therefore, short-term performance is at the best a noisy signal of managerial ability. Even if the above-mentioned complications were incorporated in the model, the calculations would become more cumbersome but the manager's short-termist incentives would be reinforced. In fact, the larger the fraction of the first period output the manager receives, the larger must be long-term compensation in order to satisfy the incentive compatibility constraint, if the first period expected output is larger with a short-term strategy. Consequently, managers receiving higher bonuses would also be granted more long-term incentives. Thus, another feature of managerial contracts, which could at a first glance suggest managerial power, could be rationalized in the context of optimal contracts.

B   Managerial effort constraints

The model implies that effort constraints, requiring that the firm's expected payment to the manager covers the effort cost in both periods, are binding if the manager has no short-termist incentives (i.e., if the incentive-compatibility constraint is not binding). It may appear unrealistic that CEOs' high recompenses are not sufficient to cover effort costs. However, the effort constraints can have different interpretations. For instance, a CEO's decision whether to participate may depend on her outside options (such as starting her own business, consulting or sitting in a large number of boards), which are less attractive when she has not acquired general skills.

The model implications are similarly unaffected if the long-term strategy's success hinges upon managerial effort at $t = 0$ (besides depending on the appropriate strategy selection). In this case, the recompense for managerial effort at $t = 0$ can be postponed. Hence, the effort constraints $\beta_1^l pX - \gamma \geq 0$, (EFS) and (EFL) become:

$$\beta_1^l pX - \gamma + \frac{\beta_2^l sX - \gamma}{1 + \delta} \geq 0$$

and

$$\beta_1^l pX - \gamma + \frac{\beta_2^l lX - \gamma}{1 + \delta} \geq 0.$$

In the optimal long-term contract, the level of managerial compensation decreases. Nevertheless, as long as $\beta_1^l \geq 0$, all the results continue to hold because there is a limit to the possibility of transferring compensation from the first to the second period.

VIII Empirical implications

Implication 1. *In deeper managerial labor markets, on average, managers receive a larger share of the firm's output together with more long-term compensation.*

Proposition 3, Proposition 4 and Proposition 7 providing expressions for β_2^{1l} and β_2^{2l} all predict that at $t = 0$ any increase in compensation above the amount justified by the effort constraint $(E_{t-1}(w_t) = \gamma)$ should be driven by better and more likely outside offers (ξ and W) and, more importantly, should make the manager's payoff potentially more sensitive –if the manager chooses not to cash in early– to long-term performance (i.e., performance two periods ahead rather than performance in the following period). Depending on parameter configurations, such a goal could be achieved with any form of (vested or unvested) equity-based compensation or other long-term incentives. Companies that award managers bonuses (i.e., compensation based exclusively on short-term performance) should pay lower overall compensation.[25]

These predictions are consistent with the U.S. evidence. Bebchuk and Grinstein (2005) show

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[25] A similar transfer to the manager could also be achieved with equity as the long-term contract can always replicate the short-term contract. As any increase in compensation according to the model should be in the form of equity compensation, managers compensated with equity should receive higher transfers on average.

that in the U.S., on average, CEO compensation has increased from 5 percent of firms' earnings in the early nineties to 12.8 percent in the period 2000-2002. Increases in compensation have occured in the form of stock options and long-term incentives. Not only the increases in compensation are associated to increases in long-term compensation as the model predicts, but the timing of the changes coincides with the increased occupational mobility of executives (Frydman, 2005; Frydman and Saks, 2010; Murphy and Zabojnik, 2004 and 2007).

Existing papers argue that the increase in CEO compensation may have been brought about by an increased importance of executives' general managerial skills in comparison to firm-specific knowledge. Differently from my model, these papers do not predict that the increases in pay should make compensation (potentially) more sensitive to long-term performance and cannot explain why firm- and industry-specific skills are still considered important (Cremers and Grinstein, 2008).[26]

Nor has my model to rely on an asymmetry in the way in which general and firm-specific skills are valued across industries. Starting from the early eighties, a wave of corporate restructuring, deregulation, and global competition may have led some firms to look for outside experienced CEOs to transform corporate strategies. This is consistent with the evidence showing that experienced CEOs are generally hired by firms as a means of restructuring (Cappelli and Hamori, 2007; Eisfeldt and Kuhen, 2010). The need of a radical change may arise randomly, with probability ς as in Section VI, for any company. In the absence of this shock, however, having a committed CEO, with the incentives to choose the value-maximizing strategy is important. An increase in ς, by making outside offers more likely, accentuates the conflict of interest between managers and firm shareholders and may lead to the observed changes in managerial compensation.

Not only the time-series changes in the U.S., but also the cross-country differences in compensation are consistent with my model. Murphy (1999) and, more recently, Fernandes, Ferreira, Matos, and Murphy (2008) show that not only U.S. CEOs are paid more than CEOs elsewhere, but also that they are paid differently. A large part of the compensation of the highest paid CEOs is in the form of equity-based compensation and other long-term incentives (i.e., stock options with various vesting periods, restricted stocks and unrestricted stocks, and other long-term incentive plans),

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[26] Other theories, also stressing the scarcity of managerial talent, imply that compensation should rise along with increases in the size of the median firm in the market (Gabaix and Landier, 2007). However, over long time horizons the distribution of firm market values is only weakly correlated with compensation (Frydman and Saks, 2010). My model does not incur this criticism.

which comprise only a small part of compensation in other countries.[27]

My model suggests that these differences depend on the managerial labor market. In the U.S., company founders generally hire professional managers early on. In countries other than the U.S., controlling shareholders entrust the firm's management to family members (Burkart, Panunzi and Shleifer, 2003; Bhattacharya and Ravikumar, 2004). As a consequence, there are few jobs for professional managers and the probability of outside offers is small. Consistently with the empirical evidence, my theory predicts that in these situations, performance-based compensation consists of a bonus or a small a amount of long-term incentives. It is also consistent with the implications of the model that, within Europe, long-term compensation and CEO pay levels are highest in the U.K., the country in which family firms are less dominant (Conyon and Schwalbach, 1999).

Others could argue that an increase in the moral hazard problem (Gayle and Miller, 2009; Edmans and Gabaix, 2010) or the desire to avoid earning manipulation may have driven the increase in long-term incentives (Edmans, Gabaix, Sadzik and Sannikov, 2010; Bemmelech, Kandel and Veronesi, 2010). The higher level of compensation associated with the latter could in turn represent a compensation for risk, which as Conyon, Core and Guay (2011) show can explain the pay differential between U.S. and U.K. While more empirical investigation is necessary to distinguish these, not necessarily alternative, mechanisms, theories based on risk do not explain why short-vesting period may contribute to deter long-term incentives. Furthermore, if increases in pay are to be considered an effect of the need to decrease earning manipulation or managers' unjustified rent extraction, it is difficult to rationalize why they occurred in the U.S., where strong investor protection is believed to impose tighter limits on insiders, and during a period in which corporate governance has been enhanced by higher institutional ownership and investor activism.[28]

My theory has other more specific implications that can potentially be tested with international

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[27]Towers Perrin's 2002 suggests that in the early 2000s CEO compensation in the U.S. was four times larger than in Europe, *and* the value of long-term incentives that U.S. CEOs receive was almost tenfold the long-term incentives of their European colleagues. Abowd and Bognanno (1995) notice the same patterns using surveys of other major human resource consulting firms. International differences in CEO compensation remain large after controlling for taxes, price level, firm size and sector (Abowd and Bognanno, 1995; Abowd and Kaplan, 1999; Conyon and Murphy, 2000).

[28]Other changes in ownership structure and corporate governance cannot jointly explain cross-country differences in CEO compensation and the changes observed in the U.S. For instance, some argue that concentrated ownership in family firms increases incentives to monitor for outside blockholders. This could certainly account for lower compensation and a weaker relation between compensation and long-term performance in family firms. However, such an explanation, could not explain the changing structure of CEO compensation in the U.S. as ownership concentration has remained stable over time.

data. First, CEOs that are not offered long-term incentives should receive roughly the same pay across countries. This implication is indirectly supported by the fact that in the U.S., these CEOs receive lower pay. Second, within a country, differences in the level of pay between CEOs who are granted long-term incentives and the ones who do not should be positively related to the depth of the managerial labor market, which could be proxied by the proportion of firms run by professional managers.

Implication 2. *Differences in the level and structure of compensation across deep and thin managerial labor markets emerge only for firms with high growth opportunities. There are no differences in compensation practices in firms with low growth opportunities; however, these industries are affected by short-termist problems in countries with deep managerial labor markets.*

Since most of the available empirical evidence explores U.S. executive compensation, the cross-country dimension of this empirical implication is largely untested. The empirical evidence for the U.S. provides some indirect empirical support. As implied by Proposition 6, the proportion of compensation (potentially) linked to long-term performance and the level of pay are larger in U.S. firms with high research and development expenditures and new economy firms (Bryan, Hwang and Lilien, 2000; Murphy, 2003; Ittner, Lambert and Larcker, 2003), in which presumably the probability that a growth opportunity materializes (ϕ) is higher. Furthermore, Proposition 7 imply that managers are granted only restricted equity if ϕ is very high. This is consistent with the finding of Kole (1997) that managers in research-intensive firms receive equity-based awards with longer vesting periods.

During recessions, growth opportunities weaken and the probability that a value-enhancing long-term strategy can be pursued decreases. The model implies that the commitment to long-term compensation becomes, ceteris paribus, less likely to be optimal. Consistently, Banerjee, Gatchev and Noe (2006) show that while in 2000, at the height of the high-tech bubble, 83 percent of U.S. firms were granting options, this percentage has decreased to 76 percent since 2003, after the downward revision of growth opportunities. Bebchuk and Grinstein (2005) also find that equity-based compensation has decreased in the U.S. since 2001, after having increased in the period 1993-2001. These changes in the structure of compensation were accompanied by a decrease in overall compensation. Weaker growth opportunities can also explain the decrease in executive compensation differences between the U.S. and the rest of the world from 2000 to 2006, documented

by Fernandes, Ferreira, Matos, and Murphy (2008).

A more direct empirical test of the model would show to what extent pay practices in deep and thin managerial labor markets differ within industries with different growth opportunities. The theory indicates that differences should emerge only in industries in which the probability that a value-enhancing long-term strategy materializes is sufficiently high.

The model also implies that if the managerial labor market is deep, it is not optimal to give managers of firms with low growth opportunities incentives to pursue value-enhancing long-term strategies. Hence, the value of firms in low-growth industries is expected to be higher in countries where the managerial labor market is thin and managers select value-enhancing long-term strategies with short-term contracts or relatively modest long-term incentives.

Implication 3. *Firms benchmark their executives' compensation against higher paying firms and industry leaders.*

Proposition 3 and 4 imply that the compensation of the highest paid managers (i.e., the managers' whose strategy constraint is binding) depends on outside offers (W), potentially more attractive than the current job, that the manager may recieve in the future. This empirical implication is consistent with the findings of Albuquerque, Franco and Verdi (2009), Bizjak, Lemmon and Nguyen (2009), Cadman, Carter and Semida (2009) and Faulkender and Yang (2010) who document that firms justify their CEOs compensation by benchmarking against larger, highly paying firms, and firms that are industry leaders. This behavior is generally interpreted as a self-serving choice aiming at inflating CEO compensation. While other theories imply that similar or slightly worse companies should be taken as benchmark, my model relying on voluntary turnover and outside offers can explain the empirical evidence in the context of optimal contracting.

The evidence that firms making larger use of benchmarking have high growth opportunities, invest in R&D and are in the high-tech sector is consistent with the theoretical implication that only firms in which the long-term strategy is available with high probability find it optimal to commit to high compensation in order to make potential outside offers less desirable. Importantly, the selected peers appear to be in the same two or three digit industries, in other words the peers are firms that are more likely to extend offers to the CEO (Cremers and Grinstein, 2008).

Existing empirical evidence shows that the apparently self-serving choice of peers affects positively executive compensation. My model offers a new empirical implication: Firms making an

apparently self-serving choice of peers should make more use of long-term compensation.

Implication 4. *Managerial turnover is higher in firms offering more long-term incentives and longer vesting periods.*

Proposition 5 implies that the optimal contract in firms with the highest growth opportunities (high ϕ) is such that the manager may voluntarily quit –even without outside offers– if the long-term strategy turns out to be unavailable. Empirically, one should observe that in firms with high proportion of long-term compensation and, as Proposition 7 implies, long vesting periods, turnover is higher as managers quit in anticipation of disappointing performance (not following disappointing performance as most of the existing literature emphasizes). Eisfeldt and Kuhenen (2010) also predict an increase in turnover in the absence of prior disappointing performance in the context of a competitive assignment frameworks, but have no predictions on the relation between turnover and the structure of compensation that is specific to my model.

While this implication of the model has not been directly tested, it is broadly consistent with empirical evidence showing that CEO turnover has increased during the nineties (Kaplan and Minton, 2006), the same period that has witnessed the changes in the structure of compensation the model highlights.[29] Moreover, existing literature provides empirical support for the following related implication of the model. If growth opportunities are revised downward ($\phi \downarrow$) after the contract has been signed, the value of the second-period compensation is lower than expected for a larger fraction of CEOs. Hence, more of them should find it optimal to quit, whether they receive an outside offer or not.[30] This implication of the model is consistent with empirical evidence showing that market and industry performance, which may capture expectations of growth opportunities, are related to CEO turnover, independently from the performance of the firm relative to the industry or the market (Kaplan and Minton, 2006). Consistently with the mechanism highlighted in the model, this relation has become more pronounced since the nineties, when long-term contracts became more widespread.

Implication 5. *Windfall payments unrelated to performance occur for CEOs that receive more long-term compensation..*

Lemma 1 implies that managers with a binding strategy contraint receive payments unrelated

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[29] Empirically, it is notoriously difficult to distinguish between force outs and voluntary quits.

[30] Note that if the firm is aware of the downward revision of growth opportunities, the firm may find it optimal to increase managerial compensation in the intermediate period (even if the manager does not receive an outside offer) in order to limit turnover costs.

to performance. This type of payment have often been indicated as evidence that managerial compensation is pure rent extraction (Bebchuck and Fried, 2004). My model indicates that they may be optimal and suggest that they should be associated not only to higher ex ante pay but also to a higher proportion of compensation potentially related to long-term performance. Once again, I am not aware of any empirical work testing this implication that is particular to my model. It appears however that it would be testable.

Implication 6. *Older CEOs at the end of their careers receive less long-term compensation.*

Brian, Hwang and Lilien (2000) find that older managers receive a lower proportion of compensation potentially related to long-term performance than average, especially if they are employed in smaller companies. This empirical finding is puzzling without taking into account the incentive problems created by outside job opportunities. For instance, Gibbons and Murphy (1992) argue that younger (not older) CEOs can be awarded more high powered-contracts contracts because the desire to establish a reputation for high ability provides them incentives to exert high effort. If, like in my model, the acquisition of general skills is not entirely congruent with the maximization of shareholder value, however, the result is reversed.

IX   Conclusions

This paper shows that the managerial labor market can help explaining not only the recent increase in CEO compensation, but also the structure of managerial contracts and differences in executive compensation across countries. Large differences in managerial contracts optimally emerge if CEOs have job-hopping opportunities. In these situations, firms with weak growth opportunities optimally renounce to prevent the CEO from pursuing self-enhancing short-term strategies and offer bonus contracts. Firms with strong growth opportunities instead find it optimal to offer the CEO a large share of long-term output.

The insights of the model go beyond the specific context of the managerial labor market. The implications are valid all the times that workers face a trade-off between the acquisition of firm-specific skills, which can improve productivity at the current job, and general skills, which increase the chances of receiving outside offers. For instance, high salaries in the banking industry appear to have come about with an increase in the finance professionals' opportunities to switch to lucrative

hedge funds. It would be interesting to explore whether the average increase of U.S. finance professionals' salaries, documented by Kaplan and Rauh (2010), has been accompanied by an increase in dispersion and a change in the structure of the contracts, as my theory suggests.

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A Appendix

A Proof of Proposition 1

It follows readily from the fact that when conditions (2) and (3) are satisfied:

- The manager always chooses the long-term strategy if offered $\beta_2^s = \frac{\gamma}{sX}$;

- The firm finds it optimal to offer $\beta_2^s = \frac{\gamma}{sX}$.

Condition (2) is more likely to be satisfied if ϕ is small. Condition (3) can be rewritten as $\frac{(1-\xi\kappa)\left(\frac{\gamma}{sX}lX-\gamma\right)}{\xi(1-\kappa)(W-\gamma)} \geq 1$; since the left-hand side decreases in ξ and W, it is more likely to be satisfied if these are small.

Finally, note that at $t=0$ the firm finds it optimal to offer $\beta_1^s = \frac{\gamma}{pX}$ and that β_1^s does not affect the manager's strategy selection.

B Proof of Proposition 2

First, assume that condition (3) is not satisfied. In this case, the manager chooses the short-term strategy even if the firm offers $\beta_2^s = \frac{\gamma}{sX}$, the highest share of the output which could be rational to offer with a short-term contract at $t=1$. Hence, in equilibrium the firm expects that the manager chooses the short-term strategy and offers $\beta_2^s = \frac{\gamma}{sX}$. At $t=0$, the manager actually finds it optimal to choose the short-term strategy.

Second, assume that condition (3) is satisfied, but condition (2) is not. In this case, there exists no equilibrium in pure strategies: If the manager expects the firm to offer $\beta_2^s = \frac{\gamma}{lX}$, she undertakes the short-term strategy. However, if the manager is believed to have undertaken the short-term strategy, the firm has an incentive to offer $\beta_2^s = \frac{\gamma}{sX}$, and, consequently, the manager would undertake the long-term strategy.

There exists only a mixed strategy equilibrium, which is determined as follows. The entrepreneur undertakes the long-term strategy with probability x_{man} and the short-term strategy with probability $1 - x_{man}$; the firm offers $\beta_2^s = \frac{\gamma}{sX}$ with probability x_{firm} and $\beta_2^s = \frac{\gamma}{lX}$ with probability $1 - x_{firm}$, , when the manager has not received outside offers.

Note that it would not be individually rational for the firm to offer $\beta_2^s > \frac{\gamma}{sX}$ because this would lower the firm's surplus without affecting the manager's incentives. Similarly, it is not individually

rational for the firm to offer $\frac{\gamma}{lX} < \beta_2^s < \frac{\gamma}{sX}$. In fact, if $\beta_2^s < \frac{\gamma}{sX}$ and the manager is pursuing the short-term strategy, her effort constraint is not satisfied and no output is produced. Offering $\frac{\gamma}{lX} < \beta_2^s < \frac{\gamma}{sX}$ is equivalent to leave the manager a larger share of the surplus when she is pursuing the long-term strategy, without affecting her incentives (as the strategy has already been chosen at $t = 1$).

The mixed strategy of the firm (x_{firm}) is determined by requiring that the manager finds it optimal to mix in equilibrium. Hence, x_{firm} must be such that the manager is indifferent between the long-term and the short-term strategies. This implies that:

$$(4) \quad x_{firm}\left[(1 - \xi\kappa)\left(\frac{\gamma}{sX}lX - \gamma\right) + \xi\kappa(W - \gamma)\right] + (1 - x_{firm})\xi\kappa(W - \gamma) = \xi(W - \gamma),$$

where the left-hand side represents the manager's expected payoff from the long-term strategy and the right-hand side is the manager's expected payoff from the short-term strategy.

Solving (4) for x_{firm}, I obtain:

$$x_{firm} \equiv \frac{\xi(1 - \kappa)(W - \gamma)}{(1 - \xi\kappa)\left(\frac{\gamma}{sX}lX - \gamma\right)}.$$

Note that $x_{firm} \in (0, 1)$. In fact, my assumptions immediately imply that $x_{firm} \geq 0$. In addition, $x_{firm} \leq 1$ implies:

$$(1 - \xi\kappa)\left(\frac{\gamma}{sX}lX - \gamma\right) \geq \xi(1 - \kappa)(W - \gamma),$$

which is always satisfied if (3) holds.

Similarly, the mixed strategy of the manager (x_{man}) must be such that the firm finds it optimal to mix in equilibrium. Hence, x_{man} must be such that the firm is indifferent between offering $\beta_2^s = \frac{\gamma}{sX}$ and $\beta_2^s = \frac{\gamma}{lX}$. This implies that:

$$(5) \quad ((1 - \phi) + \phi(1 - x_{man}))\left(1 - \frac{\gamma}{sX}\right)sX + \phi x_{man}\left(1 - \frac{\gamma}{sX}\right)lX = \phi x_{man}\left(1 - \frac{\gamma}{lX}\right)lX,$$

where the left-hand side is the firm's expected payoff from offering $\beta_2^s = \frac{\gamma}{sX}$ and the right-hand side is the expected payoff from offering $\beta_2^s = \frac{\gamma}{lX}$.

Solving (5) for x_{man}, I obtain:

$$x_{man} \equiv \frac{\left(1 - \frac{\gamma}{sX}\right) sX}{\phi\left(\left(1 - \frac{\gamma}{lX}\right) lX + \left(1 - \frac{\gamma}{sX}\right) sX - \left(1 - \frac{\gamma}{sX}\right) lX\right)}.$$

If (2) is not satisfied, the following inequality holds:

$$\phi\left[\left(1 - \frac{\gamma}{lX}\right) lX + \left(1 - \frac{\gamma}{sX}\right) sX - \left(1 - \frac{\gamma}{sX}\right) lX\right] > \left(1 - \frac{\gamma}{sX}\right) sX.$$

Hence, $x_{man} \in [0, 1]$.

The second part of Proposition 2 derives from the fact that: $\frac{\partial x_{man}}{\partial \phi} < 0$ and $\frac{\partial x_{man}}{\partial l} < 0$.

Finally, note that if the manager receives an outside offer at $t = 1$, the firm always find it optimal to offer $\beta_2^s = \frac{W}{lX}$ and the manager quits unless she is pursuing the long-term strategy. Moreover, at $t = 0$, the firm finds it optimal to offer $\beta_1^s = \frac{\gamma}{pX}$ and β_1^s does not affect the manager's strategy selection.

C Proof of Lemma 1

By contradiction, assume that an optimal long-term contract is never renegotiated. Hence, $\beta_2^l lX - W \geq 0$. This may be desirable only if the strategy constraint is binding because my assumptions imply that under this condition all the effort constraints are slack. If the strategy constraint were also not binding, the contract could not be optimal as firm shareholders could increase their payoff by decreasing β_2^l.

First, consider the case in which the firm finds it optimal to satisfy the effort constraint when the manager is pursuing the short-term strategy. The strategy constraint can be written as: $\beta_2^l lX = \xi W + (1 - \xi) \beta_2^l sX$. This implies: $\beta_2^l = \frac{\xi W}{lX - (1 - \xi) sX}$. Substituting for β_2^l, $\beta_2^l lX - W > 0$ can be rewritten as: $\frac{\xi W lX}{lX - (1 - \xi) sX} - W > 0$. It is straightforward to show that this implies: $-(1 - \xi) lX + (1 - \xi) sX > 0$, which is a contradiction.

Second, consider the case in which the firm does not find it optimal to satisfy the effort constraint when the manager is pursuing the short-term strategy. I can demonstrate that the optimal long-term contract must be renegotiated as above. By contradiction, assume that this is not the case. The relevant incentive-compatibility is now: $\beta_2^l lX + \kappa \xi \max\left\{W - \beta_2^l lX, 0\right\} - \gamma \geq \xi (W - \gamma)$. Under the assumption that the renegotiation payoff is zero, this can be written as: $\beta_2^l lX - \gamma = \xi (W - \gamma)$.

Thus, $\beta_2^l = \frac{\xi W+(1-\xi)\gamma}{lX}$. In turn, this implies that $\beta_2^l lX = \frac{\xi W+(1-\xi)\gamma}{lX}lX < W$. Therefore, the contract would be renegotiated, which is once again a contradiction.

D   Proof of Proposition 3

Substituting $\beta_2^l = \frac{\gamma}{sX}$ into (ST'), the strategy constraint can be re-written as:

$$(6) \quad (1-\xi\kappa)\left(\frac{\gamma}{sX}lX - \gamma\right) \geq \xi(1-\kappa)(W-\gamma).$$

It follows readily that the strategy constraint is not binding if (3) holds. Thus, $\beta_2^l = \frac{\gamma}{sX}$. If (3) does not hold, β_2^l is determined from the strategy constraint.

E   Proof of Corollary 1

It is straightforward to establish that $\beta_2^l = \frac{\xi W(1-\kappa)}{(1-\xi\kappa)lX-(1-\xi)sX}$ is increasing in W. Also, $\frac{\partial \beta_2^l}{\partial \xi} = -\frac{1}{X}W(\kappa-1)\frac{l-s}{(l-s+s\xi-l\kappa\xi)^2} > 0$.

F   Proof of Proposition 4

The expression for β_2^l is derived from the binding strategy constraint (IC"). The effort constraint is actually not satisfied in the second period when the manager is pursuing the short-term strategy only if $\beta_2^l = \frac{\xi(1-\kappa)}{1-\xi\kappa}\frac{W-\gamma}{lX} - \frac{\gamma}{lX} < \frac{\gamma}{sX}$. Thus, if the firm values the commitment of a long-term contract, the effort constraint is not satisfied when the manager is pursuing a short-term strategy only if lX is sufficiently large. It is straightforward to establish that β_2^l is increasing in W. Also, $\frac{\partial \beta_2^l}{\partial \xi} = \frac{(1-\kappa)}{1-\xi\kappa}\frac{W-\gamma}{lX} + \frac{\xi\kappa(1-\kappa)(W-\gamma)}{((1-\xi\kappa)lX)^2} > 0$.

G   Proof of Proposition 5

Not satisfying the effort constraint in the second-period when the manager is pursuing the short-term strategy guarantees a higher expected payoff to the firm if:

$$\phi \left(\underbrace{(1-\xi\kappa)\left(1-\frac{\xi(1-\kappa)W}{(1-\xi\kappa)lX-(1-\xi)sX}\right)lX+\xi\kappa\left(lX-W\right)}_{A} \right) +$$

$$+ (1-\phi)\left(1-\frac{\xi W(1-\kappa)}{(1-\xi\kappa)lX-(1-\xi)sX}\right)sX\left(1-\xi\right)$$

$$\leq \phi \left(\underbrace{(1-\xi\kappa)\left(1-\frac{\xi(1-\kappa)}{1-\xi\kappa}\frac{W-\gamma}{lX}-\frac{\gamma}{lX}\right)lX+\xi\kappa\left(lX-W\right)}_{B} \right),$$

where the left-hand (right-hand) side is the firm's payoff if it satisfy (does not satisfy) the effort constraint when the manager pursues the short-term strategy. Note that the expected payoff conditionally on the long-term strategy being pursued is always larger if the effort constraint is not satisfied when the manager pursues the short-term strategy (i.e., $B > A$) because, by construction, if the effort constraint is not satisfied $\beta_2^l = \frac{\xi(1-\kappa)}{1-\xi\kappa}\frac{W-\gamma}{lX}-\frac{\gamma}{lX} < \frac{\gamma}{sX}$, while if the effort constraint is satisfied $\beta_2^l = \frac{\xi(1-\kappa)W}{(1-\xi\kappa)lX-(1-\xi)sX} > \frac{\gamma}{sX}$. Thus, the above inequality is more likely to be satisfied if ϕ is large, because in this case the second-term of the left-hand side is relatively small. Similarly, the inequality is more likely to be satisfied if lX is large because by not satisfying the effort constraint when the manager pursues the short-term strategy, the firm obtains a larger share of lX.

H   Proof of Proposition 6

Here I evaluate under what conditions the commitment made possible by a long-term contract may give the firm a strictly larger expected payoff than the short-term contract. I compare the firm's payoffs with a long-term and a short-term contract. Note that at $t = 0$ the firm finds it optimal to offer $\beta_1^s = \frac{\gamma}{pX}$ and that β_1^s does not affect the manager's strategy selection. Hence, I compare only second-period payoffs.

Propositions 3 and 4 show that in a long-term contract that guarantees a different payoff than a short-term contract $\beta_2^l \in \left\{ \frac{\gamma}{sX}, \frac{\xi W(1-\kappa)}{(1-\xi\kappa)lX-(1-\xi)sX}, \frac{\xi(1-\kappa)}{1-\xi\kappa}\frac{W-\gamma}{lX}+\frac{\gamma}{lX} \right\}$. Below, I consider these three cases.

First case: $\beta_2^l = \frac{\gamma}{sX}$

If (3) is satisfied, the manager finds it optimal to pursue the long-term-strategy when offered $\beta_2^s = \frac{\gamma}{sX}$. In what follows, I show that if this is the case, the commitment offered by a long-term contract is always desirable.

First, consider the case in which (2) is satisfied. The long-term contract guarantees the same payoffs of a short-term contract as in this case the firm does not need to commit to leave the manager a share of the output $\frac{\gamma}{sX}$.

Second, consider the case in which (2) is not satisfied. In this case, the long-term contract guarantees the firm a strictly larger payoff than the short-term contract (under which the manager would undertake the long-term strategy with probability $x_{man} < 1$) as:

$$
\begin{aligned}
& (1-\phi)(1-\xi)\left(1-\frac{\gamma}{sX}\right)sX + \phi\left((1-\xi\kappa)\left(1-\frac{\gamma}{sX}\right)lX + \xi\kappa\left(lX-W\right)\right) \\
(7) \quad \geq \quad & [(1-\phi)+\phi(1-x_{man})](1-\xi)\left(1-\frac{\gamma}{sX}\right)sX + \\
& +\phi x_{man}\left((1-\xi\kappa)\left(1-\frac{\gamma}{sX}\right)lX + \xi\kappa\left(lX-W\right)\right).
\end{aligned}
$$

The right-hand side of (7) is the expected payoff of the firm in the short-term contract mixed strategy equilibrium described in Proposition 2, because in equilibrium, the firm must be indifferent between offering $\beta_2^s = \frac{\gamma}{sX}$ and $\beta_2^s = \frac{\gamma}{lX}$. Condition (7) is always satisfied because the long-term contract allows the firm to obtain the payoff from the long-term strategy with higher probability.

It is actually optimal for the firm to commit to offer $\beta_2^s = \frac{\gamma}{sX}$ and thus satisfy the effort constraint when the manager pursues the short-term strategy if:

$$
(8) \quad (1-\phi)(1-\xi)\left(1-\frac{\gamma}{sX}\right)sX + \phi\left(1-\frac{\gamma}{sX}\right)lX \geq \phi\left(1-\frac{\xi(1-\kappa)}{1-\xi\kappa}\frac{W-\gamma}{lX}-\frac{\gamma}{lX}\right)lX.
$$

The right-hand side is the firm's expected payoff if the the effort constraint is not satisfied when the manager pursues the short-term strategy and $\beta_2^l = \frac{\xi(1-\kappa)}{1-\xi\kappa}\frac{W-\gamma}{lX}+\frac{\gamma}{lX}$. Condition (8) is always satisfied if (2) holds, but it is less restrictive as $\beta_2^l = \frac{\xi(1-\kappa)}{1-\xi\kappa}\frac{W-\gamma}{lX}+\frac{\gamma}{lX} > \frac{\gamma}{lX}$. Hence, there are instances in which the commitment made possible by a long-term contract leads to a strictly larger payoff for the firm.

Second Case: $\beta_2^l = \frac{\xi W(1-\kappa)}{(1-\xi\kappa)lX-(1-\xi)sX}$

The firm's payoff is higher with a long-term contract than with a short-term contract if:

$$(9) \quad \underbrace{\left(\left(1 - \frac{\xi W (1-\kappa)}{(1-\xi\kappa)lX - (1-\xi)sX}\right)lX - \left(W - \frac{\xi W(1-\kappa)}{(1-\xi\kappa)lX - (1-\xi)sX}lX\right)\xi\kappa\right)}_{C}\phi +$$

$$+\underbrace{\left(1 - \frac{\xi W(1-\kappa)}{(1-\xi\kappa)lX - (1-\xi)sX}\right)sX\,(1-\xi)}_{D}(1-\phi)$$

$$\geq (1 - x_{firm})\left(\begin{array}{c}((1-\phi) + \phi(1-x_{man}))\,(1-\xi)\left(1 - \frac{\gamma}{sX}\right)sX + \\ \phi x_{man}\left((1-\xi\kappa)\left(1 - \frac{\gamma}{sX}\right)lX + \xi\kappa\,(lX - W)\right)\end{array}\right)$$

$$+ x_{firm}\phi x_{man}\left((1-\xi\kappa)\left(1 - \frac{\gamma}{lX}\right)lX + \xi\kappa\,(lX - W)\right).$$

Since the firm must be indifferent between offering $\beta_2^s = \frac{\gamma}{lX}$ and $\beta_2^s = \frac{\gamma}{sX}$ in a mixed strategy equilibrium, the right-hand side of (9) can be rewritten as $\phi x_{man}\left((1-\xi\kappa)\left(1 - \frac{\gamma}{lX}\right)lX + \xi\kappa\,(lX - W)\right)$. Substituting in the latter $x_{man} \equiv \frac{\left(1 - \frac{\gamma}{sX}\right)sX}{\phi\left(\left(1 - \frac{\gamma}{lX}\right)lX + \left(1 - \frac{\gamma}{sX}\right)sX - \left(1 - \frac{\gamma}{sX}\right)lX\right)}$, the right-hand side of (9) can be written as $\frac{\left(1 - \frac{\gamma}{sX}\right)sX}{\left(1 - \frac{\gamma}{lX}\right)lX + \left(1 - \frac{\gamma}{sX}\right)sX - \left(1 - \frac{\gamma}{sX}\right)lX}\left((1-\xi\kappa)\left(1 - \frac{\gamma}{lX}\right)lX + \xi\kappa\,(lX - W)\right).$

Overall, the left-hand side of (9) increases in ϕ, as $\Gamma \equiv lX\left(1 - \beta_2^l\right)(1 - \xi\kappa) + (lX - W)\xi\kappa >$ $\Delta \equiv sX\left(1 - \beta_2^l\right)(1 - \xi)$. Hence, the long-term contract is more likely to be preferred to the short-term contract if ϕ increases, as the right-hand side does not depend on ϕ.

Third case: $\beta_2^l = \frac{\xi(1-\kappa)}{1-\xi\kappa}\frac{W-\gamma}{lX} + \frac{\gamma}{lX}$

If condition (8) does not hold and lX is large, the firm may find it optimal to commit to offer $\beta_2^l = \frac{\xi(1-\kappa)}{1-\xi\kappa}\frac{W-\gamma}{lX} + \frac{\gamma}{lX} < \frac{\gamma}{sX}$ and the effort constraint is never satisfied if the manager is pursuing the short-term strategy.

In this case, the long-term contract is preferred if:

$$(10) \quad \phi\left((1-\xi\kappa)\left(1 - \frac{\xi(1-\kappa)}{1-\xi\kappa}\frac{W-\gamma}{lX} - \frac{\gamma}{lX}\right)lX + \xi\kappa\,(lX - W)\right)$$

$$\geq \frac{\left(1 - \frac{\gamma}{sX}\right)sX}{\left(1 - \frac{\gamma}{lX}\right)lX + \left(1 - \frac{\gamma}{sX}\right)sX - \left(1 - \frac{\gamma}{sX}\right)lX}\left((1-\xi\kappa)\left(1 - \frac{\gamma}{lX}\right)lX + \xi\kappa\,(lX - W)\right).$$

As above, the left-hand side increases in ϕ, while the right-hand side, which is the same as in (9), does not depend on ϕ. Hence, the long-term contract is more likely to be optimal if ϕ increases.

Note that the firm actually finds it optimal to satisfy the effort constraint when the manager is

pursuing the short-term strategy if:

$$
\text{(11)} \quad \phi \left(\underbrace{(1 - \xi\kappa)\left(1 - \frac{\xi(1-\kappa)W}{(1-\xi\kappa)lX - (1-\xi)sX}\right) lX + \xi\kappa (lX - W)}_{E} \right) +
$$

$$
+ (1 - \phi)\left(1 - \frac{\xi W(1-\kappa)}{(1-\xi\kappa)lX - (1-\xi)sX}\right) sX (1 - \xi)
$$

$$
\geq \quad \phi \left(\underbrace{(1 - \xi\kappa)\left(1 - \frac{\xi(1-\kappa)}{1-\xi\kappa}\frac{W-\gamma}{lX} - \frac{\gamma}{lX}\right) lX + \xi\kappa (lX - W)}_{F} \right).
$$

Since $F > E$, inequality (11) is more likely to be satisfied for low levels of ϕ. If condition (8) does not hold, a long-term contract is optimal iff:

$$
\max \left\{ \begin{array}{c} \phi\left((1 - \xi\kappa)\left(1 - \frac{\xi(1-\kappa)W}{(1-\xi\kappa)lX-(1-\xi)sX}\right) lX + \xi\kappa (lX - W)\right) + \\ + (1 - \phi)\left(1 - \frac{\xi W(1-\kappa)}{(1-\xi\kappa)lX-(1-\xi)sX}\right) sX (1 - \xi), \\ \phi\left((1 - \xi\kappa)\left(1 - \frac{\xi(1-\kappa)}{1-\xi\kappa}\frac{W-\gamma}{lX} - \frac{\gamma}{lX}\right) lX + \xi\kappa (lX - W)\right) \end{array} \right\}
$$

$$
\geq \quad \frac{\left(1 - \frac{\gamma}{sX}\right) sX}{\left(1 - \frac{\gamma}{lX}\right) lX + \left(1 - \frac{\gamma}{sX}\right) sX - \left(1 - \frac{\gamma}{sX}\right) lX} \left((1 - \xi\kappa)\left(1 - \frac{\gamma}{lX}\right) lX + \xi\kappa (lX - W)\right).
$$

I Proof of Lemma 2

When the manager sells her unrestricted rights to the second period output in the intermediate period, these have positive value if the manager is expected to spend effort if she is pursuing the short-term strategy. This implies: $\beta_2^{2l} \geq \frac{\gamma}{sX}$.

J Proof of Lemma 3

The manager finds it optimal not to sell when she is pursuing a short-term strategy if $\frac{lX}{1+\delta} \geq sX$. If the condition in Lemma 3 were not satisfied, the manager would sell her rights to the second-period output in the intermediate period even if she had undertaken the long-term strategy and the sale of stocks revealed to market participants that the horizon of the project is short. This is the case if the manager is very impatient. In this case, setting $\beta_2^{1l} > 0$ has no impact on the incentive-compatibility constraint and the effort constraints. This implies that $\beta_2^{1l} = 0$ is optimal.

If the condition in Lemma 3 is satisfied, it is easy to see that an increase in β_2^{1l} always has a larger effect on the left-hand side than on the right-hand side of the strategy constraint, which can be written as follows:

$$
(12) \quad \left(\beta_2^{1l} + \beta_2^{2l}\right) lX - \gamma + \xi\kappa\left(W - \left(\beta_2^{1l} + \beta_2^{2l}\right) lX\right)
$$
$$
\geq \quad \beta_2^{1l}\left(1 - \xi\right)sX + \xi W - \gamma + \left(1 - \xi\right)\beta_2^{2l}sX.
$$

K   Proof of Proposition 7

As long as $\beta_2^{2l} \geq \frac{\gamma}{sX}$, the firm finds it optimal to allow the manager to sell as many rights to the second period output as possible as it profits from the discount $\frac{\delta}{1+\delta}sX$. Thus, if the manager is impatient, an optimal long-term contract in which she spends effort also when she is pursuing the short-term strategy involves $\beta_2^{2l} = \frac{\gamma}{sX}$; since the strategy constraint is necessarily binding if the manager perceives a rent, solving for β_2^{1l} I obtain: $\beta_2^{1l} = \frac{\xi W(1-\kappa)+\gamma(1-\xi)-\gamma(1-\xi)\kappa\frac{lX}{sX}}{(1-\xi\kappa)lX-(1-\xi)sX}$. Note that $\beta_2^{1l} + \beta_2^{2l} = \frac{\xi W(1-\kappa)}{(1-\xi\kappa)lX-(1-\xi)sX}$, where the latter is the share of second period output in the contract with only restricted stocks.

The optimality of this contract is derived as in the proof of Proposition 6. In particular, in inequality (9), term D is still lower than the right-hand side. Therefore, ϕ ought to be high is inequality (9) has to be satisfied. However, now the firm's payoff from the long-term contract derived under the condition that the manager provides effort when she is pursuing the short-term strategy has to be augmented by $\frac{\xi W(1-\kappa)+\gamma(1-\xi)-\gamma(1-\xi)\kappa\frac{lX}{sX}}{(1-\xi\kappa)lX-(1-\xi)sX}\frac{\delta}{1+\delta}sX(1-\xi)$, when the long-term strategy is not available. Therefore, this increases the range of parameters for which the long-term contract is optimal.

L   Proof of Corollary 2

As in Subsection V.A, in equilibrium the manager sells only if she is pursuing the short-term strategy. I assume that market participants observe managerial sales,[31] but not outside offers. Thus, since this reveals them that the manager is pursuing the short-term strategy and they are aware that in this case the manager may quit with probability $1-\xi$, they are willing to purchase an unrestricted right to the second-period output at price $(1 - \xi)sX$ as long as $\beta_2^{2l} = \frac{\gamma}{sX}$. For the same

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[31] The results would be qualitatively similar if they did not.

reasons as in the previous section, unrestricted rights to second-period output affect the equilibrium in a non-trivial way only if the discount is such that the manager chooses to hold them until $t = 2$ when she is pursuing the long-term strategy, but sells them when she is pursuing the short-term strategy. This is the case if the following necessary condition is satisfied: $\frac{(1-\xi)sX}{lX} < \frac{1}{1+\delta} < 1 - \xi$. The first inequality derives from the fact that the manager must find optimal not to sell when she is pursuing the long-term strategy. The second inequality depends on the fact that selling rather than holding the stocks to maturity has to guarantee the manager a larger payoff: $(1-\xi)sX > \frac{sX}{1+\delta}$, which implies $(1-\xi)(1+\delta) > 1$.

The strategy constraint is now:

$$(13) \qquad \left(\beta_2^{1l} + \beta_2^{2l}\right) lX - \gamma + \xi\kappa\left(W + (1-\xi)(1+\delta)sX - \left(\beta_2^{1l} + \beta_2^{2l}\right)lX\right)$$
$$\geq \quad \beta_2^{1l}(1-\xi)(1+\delta)sX + \xi W - \gamma + (1-\xi)\beta_2^{2l}sX.$$

Note that if the manager owns unrestricted rights to the second-period output β_2^{1l} and receives an outside offer in the intermediate period, her reservation wage is $W + \beta_2^{1l}(1-\xi)sX(1+\delta)$, where $(1-\xi)sX$ is the price that she can obtain by threatening to sell the unrestricted stocks at $t = 1$ and $(1+\delta)$ takes into account that the manager is impatient.

Since also in this case the strategy constraint has to be binding for unrestricted rights to the second-period output to ever be optimal, I obtain: $\beta_2^{1l} = \frac{\xi W(1-\kappa) + \gamma(1-\xi) - \gamma(1-\xi)\kappa\frac{lX}{sX}}{(1-\xi\kappa)lX - (1-\xi)(1-\xi\kappa)(1+\delta)sX}$. Since the necessary condition for unrestricted stocks to be optimal implies $(1-\xi\kappa)(1+\delta) > 1$, a contract in which unrestricted rights to the second-period output can be sold to the market is always dominated by a contract in which they must be sold to the firm.

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