Explaining International Differences in CEO Contracts: Transparency and Long-Term Incentives*

Preliminary and Incomplete Version

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Abstract

This paper argues that large international differences in CEO contracts may depend on differences in the managerial labor market. I show that dramatic differences in managerial contracts may emerge when growth opportunities improve. In environments where the value of reputation is low, managerial compensation can be tied to short-term performance and increases only slightly (as long as there are small costs of managerial turnover). When the value of reputation is high, instead, long-term and short-term compensation must increase dramatically in order to give managers an incentive to pursue growth opportunities. These predictions are tested using hand-collected data. Preliminary results are supportive of the model's theoretical implications.

JEL Codes: G32; J33; L14

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I Introduction

Chief executives officers' (CEOs) compensation is at the center of the academic and policy debate, which so far has focused and often criticized the high level of U.S. CEOs' remuneration. To a large extent, the high level of stock based compensation of U.S. CEOs has been considered as a way to extract rents from shareholders without provoking public outrage (Bebchuk and Fried, 2004). Several papers have underlined the undesirable consequences that compensation closely tied to the value of stock and option holdings can have on earning management (Bergstresser and Philippon, 2004).

Somehow less attention has been devoted to the theoretical analysis of the *ex ante determinants* of managerial contracts.[1] Contract features vary enormously both across countries and across firms within the same country. Murphy (1999) shows that U.S. CEOs not only are paid more than CEOs elsewhere, but also that they are paid differently. A large part of their compensation is in the form of long-term incentives (i.e., non-vested stock options with vesting periods longer than three years, out-of-the-money stock options, restricted stocks, and other long-term incentive plans), which comprise only a small part of compensation in other countries. Even if stock options and other forms of long-term compensation are rapidly being adopted outside the U.S., Towers Perrin's 2002 report suggests that differences are persistent: CEO compensation in the U.S. is still four times larger than in Europe, *and* the value of long-term incentives U.S. CEOs receive is almost tenfold the long-term incentives of their European colleagues.[2] Additionally, even within a country, managers are sometimes compensated with restricted stocks or options and others are not: A better understanding of these differences, and of the institutional and economic contexts in which they are optimal, can definitively add to our understanding of CEO compensation.

In this paper, I show that differences in the managerial labor market and expectations of growth opportunities can help explain why compensation is sometimes tied to long-term performance. Pursuing long-term growth opportunities may have a negative impact on reputation in the short-

[1] A large part of the literature focuses on the *ex post* measurement of incentives and the valuation of stocks and restricted stocks. See Core, Guay and Larker (2002) and Murphy (1999) for excellent surveys.

[2] Abowd and Bognanno (1995) notice the same patterns using surveys of other major human resource consulting firms, but are unable to suggest an explanation why only U.S. CEOs receive such large long-term compensation plans.

term because the manager may be less likely to produce early signals of high ability. The cost of sacrificing short-term reputation may differ depending on the depth of the managerial labor market (which affects outside options) and on the probability that early signals of managerial ability are observed by outsiders. If the managerial labor market is thin or transparency is low (early signals of managerial ability are unlikely to be observed), the opportunity cost of pursuing long-run growth opportunities is low. Hence managers may have an incentive to undertake long-term projects even if their compensation is not strongly tied to long-term performance. Similarly, if long-term growth opportunities have small probability to arise, the expected cost for firm shareholders to forgive investment in the long-term project is low. We may thus observe that managerial compensation is tied only to short-term incentives.

Dramatic differences in managerial contracts may emerge as growth opportunities improve. In environments where the value of reputation is low, managerial compensation may continue to be tied to short-term performance and increases only slightly (as long as there are small costs from managerial turnover). When the value of reputation is high, instead, both long-term and short-term compensation must increase dramatically to give managers an incentive to pursue growth opportunities.

To put it differently, it may be optimal for firm shareholders to forgo the ability to renegotiate in the intermediate period writing a contract that establish the compensation for the two following periods and makes it insensitive to reputation. In such a contract, the CEO compensation is made dependent on long-run performance, for instance through restricted stocks or options that vest over time. Hence, the model predicts that clauses that make CEO compensation dependent on long-term performance are used especially in countries and in sectors with larger growth opportunities and higher level of transparency. This is compatible with the empirical evidence on international CEO compensation indicating that recourse to long-term compensation is larger in countries, like the U.S., where stock prices exhibit more idiosyncratic volatility indicating that more firm-specific information is produced.

In the model, long-term compensation perform two roles: Deferred compensation gives an incentive to the CEO to undertake a project that has high return in the long-run making her com-

pensation sensitive to long-run performance. Additionally, it is used for CEO retention: The larger the share of the output that is offered to the CEO in the second period the lower the probability that the CEO will quit because she receives a better outside offer. Long-term compensation, however, has a cost if the manager is impatient. The manager values current remuneration more than future remuneration. In this context, it may still be optimal to award the CEO *non-restricted shares or stock options* together with restricted shares. Long-term compensation involves an unnecessary cost if ex post no long-term project is available. Non-restricted stocks or options can reduce this cost by allowing the manager to sell some of its rights to future output in the intermediate period when no long-term project is available.

This paper is closely related to the career concern literature initiated by Holmström (1999). I study a career concern model similar to Narayanan (1985) and Stein (1988 and 1989). The manager may have an incentive to choose a short-term project, even if a long-term project with higher expected return is available because the short-term project produces early signals of managerial productivity, which in turn may be useful to enhance her own reputation in the managerial labor market. The horizon of the available projects is assumed to be non-observable to outsiders and, hence, non-contractible. Contrary to previous literature, I study the characteristics of the contracts that can give the manager an incentive to undertake the efficient project. This is similar to Gibbons and Murphy (1992), who analyze the structure of optimal contracts within a career concern model. The results I obtain, however, are very different because I allow for the choice of investment horizon. Most importantly, I study a long-term contract, while the existing literature has mostly focused on the inefficiency arising from short-term contracts when managers have career concerns. The problem I analyze is most closely related to Holmström and Ricart i Costa (1986), who analyze how long-term contracts can give an incentive to report information on the most efficient project when the manager has career concerns. Also in their model, committing to long-term compensation is necessary to give the manager an incentive to report information truthfully. I show that this applies also if the manager is free to choose the project horizon. Additionally, and most importantly, I analyze the choice between short-term and long-term contracts and how the characteristics of long-term contracts depend on firm growth opportunities and transparency.

This paper is also related to a large literature that following Holmström (1979) and Baker (1992) has concentrated on how to choose the performance measures to which to subordinate managerial compensation: Managerial compensation is expected to be more sensitive to performance when the available performance measures are less noisy. This result depends on the fact that the manager is assumed to be risk averse and therefore it is not optimal to transfer risk on the manager if this does not give strong incentives. In this model, instead, the manager is risk neutral: Hence, transparency should not matter for CEO compensation, if it is interpreted as a noise to the performance measure. I show that transparency matters because it affects how visible to outsiders the productivity of the manager is. Hence, it affects the manager's outside options and ultimately managerial compensation.

Other papers have analyzed the ex ante determinants of stock-based compensation, focusing on different aspects of managerial contracts. For instance, Milbourn (2003) has shown that stock-based pay sensitivities depend positively on CEO reputation. Oyer (2003) demonstrates that firms might choose to implement stock options plans, which appear to reward for luck, in order to retain employees when their outside option improves. I show that the managerial labor market may affect not only the participation constraint as Oyer argues, but also ex ante incentives. In this way, I can shed light on the timing of CEOs' compensation and the determinants of international differences in managerial contracts.

The remainder of this paper is organized as follows. Section II presents the model. Section III describes the optimal short-term contracts and the conditions under which they can give an incentive to undertake the long-term project. Section IV describes the long-term contracts. Section V presents some empirical evidence. Section VI concludes.

II The model

I study optimal contracts in a model of career concerns in which the manager can choose the investment horizon. Growth opportunities are modelled as the probability that a long-term highly profitable project becomes available after the contract between the manager and the firm has been signed. Pursuing the long-term project has a negative impact on managerial reputation in the

short-term because the manager is likely to produce early signals of high ability if she is working for the long-term.

Differences in the intensity of career concerns are modelled as the probability that in the intermediate period some information about managerial productivity becomes public. This directly captures the availability of firm-specific information: In more transparent environments, early signals of ability are observed with higher likelihood because it is easier to observe the outcome of managerial actions. The empirical evidence showing that firm-specific information is incorporated in prices to a lesser extent in some markets (Morck, Yeung and Yu, 2000; Jin and Myers, 2005) supports large cross-country differences in the availability of firm-specific information.

Career concerns may also differ because the markets for professional managers is more active in some countries rather than in others. In this case, the value of reputation is different because it affects the manager's outside options only if an offer actually materializes. Alternatively, reputation may directly affect the probability of receiving an outside offer. While the model is directly applicable to study optimal contracts in situations in which the amount of firm-specific information differs, the model could be easily modified to capture differences in the depth of managerial labor market and would have similar implications for the optimality of managerial contracts.

A Timing

The timing of the events is as follows:

First Period

- A contract is signed between a manager and firm shareholders.
- The manager observes whether a long-term project is available and chooses the investment horizon.
- The output is realized. With some probability agents observe an informative signal of the managerial ability and update their beliefs. The manager receives her first period compensation.

- The manager has the possibility to sell non-restricted rights to the second period output if she owns any.

Second Period

- 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 renegotiate the contract. The manager decides whether to switch firm.
- The output is realized and the manager receives her second period compensation.

B The managers

There is a fixed set of managers who differ in their ability, a. The managerial ability a has mean $\overline{a}_0$ and can be either high (a_H) or low (a_L). The ex ante probability of a manager having high ability is ν. The probability distribution of the ability is common knowledge

Managers maximize their expected utility. They are risk neutral but discount future income at rate $\delta < 1$. A manager's expected utility at $t = 0$ is:

$$E_0(U_0) = E_0(w_1^c) + \delta E_0(w_2^c), \tag{1}$$

where w_t^c is the compensation received in period t, under contract c. Contracts can be either long-term (l) or short-term (s).

The assumption that agents are impatient is common in the literature on career concerns (see Holmström, 1999; Gibbons and Murphy, 1992; and Acemoglu, Kremer and Mian, 2004). It is particularly important in the context of this paper: The manager prefers to receive her wage as early as possible. However, as I show later, this would strengthen her incentives to choose an inefficient short-term project in order to improve the market expectations on her ability and increase her future wage. A long-term contract may give the manager incentives to pursue a long-term project by postponing her compensation. But it produces a deadweight loss because the manager derives larger utility from present than from future income.

C Firms and investment opportunities

An infinite number of firms with ex ante identical investment opportunities compete for hiring a cohort of young managers. Young managers are ex ante identical and neither firms nor managers know their abilities. Ability influences positively the productivity of managers in the second period (in other words, the second period expected output increases in managerial ability).

The return on investment also depends on the horizon of the project (h), chosen by the manager. The project may have long (l) or short (s) horizon: $h \in \{l, s\}$. Any project requires an investment of $\frac{I}{2}$ at the beginning of each period. A long-term project is available with probability ϕ, strictly less than 1. If a long-term project is available, it is expected to be more profitable than a short-term project in the long run. Only the manager can observe whether a long-term project is available. Hence the horizon of the project is neither observable nor contractible.

In the first period, the manager produces output $x_1 = X$ with probability p whatever the investment horizon and the managerial ability are. A manager who has chosen horizon h produces high output, $x_2 = X$, at date 2 with probability $p_2^h = a + h$, if a reinvestment $\frac{I}{2}$ is made at $t = 1$. The output is equal to zero otherwise. The realization of the output is not correlated across firms. I assume that $l > s$ and that $a_H + l \leq 1$. Additionally, even a short-term project run by a low-ability manager is viable: $(a_L + s) X - \frac{I}{2} > 0$. Similarly, the expected output in the first period is sufficient to cover investment: $pX - \frac{I}{2} \geq 0$.

Although the long-term project is efficient, it has two drawbacks from the point of view of the manager. First, it can be realized only if the manager continues to work for the same firm in the second period, while the short-term project can be realized in any firm. Hence a manager who chooses a long-term project is subject to hold up by the current employer. Second, a manager with long horizon is less likely to generate an imperfect signal of high ability, observable by the market and the current employer, at the end of the first period.

D Ability signals and transparency

At the end of the first period, firm and outside investors may observe an imperfect signal of managerial ability. The signal is observed with probability ξ. The parameter ξ captures the level

of transparency.

The realization of the signal, y, may be good (G) or bad (B). The probability distribution depends on the project horizon chosen by the manager and on the managerial ability. A signal of high ability, $y = G$, is observed with probability λ_a (σ_a) if the manager has chosen a long-horizon (short-horizon) project and has ability a. A bad signal is observed otherwise: $y = B$.

The following inequalities hold:

$$0 \leq \lambda_L < \frac{1}{2} < \sigma_L < \lambda_H < \sigma_H \leq 1,$$

where $\lambda_a - \alpha = \sigma_a$, and $\alpha > 0$.

Firm and outside investors update their prior beliefs on the ability of the manager depending on the realization of the signal. Assume that firm and outside investors believe that the manager has undertaken a long-term investment with probability $\widehat{h}_1$. After observing a signal $y = G$, their posterior belief that the manager has high ability is:

$$\text{Prob}\{a = a_H | y = G\} =$$

$$= \frac{\left[\widehat{h}_1 \lambda_H + (1 - \widehat{h}_1)\sigma_H\right] \nu}{\left[\widehat{h}_1 \lambda_H + (1 - \widehat{h}_1)\sigma_H\right] \nu + \left[\widehat{h}_1 \lambda_L + (1 - \widehat{h}_1)\sigma_L\right] (1 - \nu)}$$

Similarly, the probability of a high ability manager after a bad signal is:

$$\text{Prob}\{a = a_H | y = B\} =$$

$$= \frac{\left[\widehat{h}_1 (1 - \lambda_H) + (1 - \widehat{h}_1)(1 - \sigma_H)\right] \nu}{\left[\widehat{h}_1 (1 - \lambda_H) + (1 - \widehat{h}_1)(1 - \sigma_H)\right] \nu + \left[\widehat{h}_1 (1 - \lambda_L) + (1 - \widehat{h}_1)(1 - \sigma_L)\right] (1 - \nu)}$$

It follows immediately from the assumptions that $\text{Prob}\{a = a_H | y = G\} > \text{Prob}\{a = a_H | y = B\}$.

This implies that $E_1\left(a|y = G, \widehat{h}_1\right) > E_1\left(a|y = B, \widehat{h}_1\right)$. Additionally, the probability that the manager has high ability is increasing in the beliefs that the manager has chosen a long-term project at $t = 0$, $\widehat{h}_1$, whatever the realization of the signal y is.

The manager has an incentive to undertake the short-term project because for any realization of y: $E_0\left[E_1\left(a|y, \widehat{h}_1, h_2 = s\right)|h_1 = s\right] > E_0\left[E_1\left(a|y, \widehat{h}_1, h_2 = s\right)|h_1 = l\right]$. In other words, by choosing a short-term project the manager can affect positively her reputation. Lemma 1 proves that the incentive to do so becomes stronger as ξ increases.

Lemma 1 $E_0\left[E_1\left(a|y, \widehat{h}_1, h_2 = s\right)|h_1 = s\right] - E_0\left[E_1\left(a|y, \widehat{h}_1, h_2 = s\right)|h_1 = l\right]$ *is increasing in* ξ.

For any given beliefs on the manager's project choice, the manager can positively affect investors' expectations on her ability by choosing a short-term project. The effect of the project horizon choice on investors' expectations is similar to the one pointed out by Stein (1988) and Narayanan (1985) in models where managers are assumed to have short-term contracts without performance pay. The problem I analyze is similar to Acemoglu, Kremer and Mian (2003), who show that labor markets and carreer concerns can stimulate unproductive signaling effort. However, they draw conclusions for the organization of production and argue that in areas where these problems are more pronounced may be optimal to reduce transparency, by creating firms. Instead, I show how carreer concerns, which are positively related to ξ, affects the characteristics of the optimal contract and in particular its maturity in this context.

E Contracts

The signal of managerial ability is assumed to be observable but not verifiable. Hence, since the horizon of the available projects and the project that the manager is actually pursuing are not observable, managerial remuneration can only be made contingent on output.

I assume that the firm can commit to a long-term contract, but the manager cannot. By offering the manager stocks or stock options at $t = 0$, for instance, the firm can credibly commit to make the compensation dependent on long-run performance as the manager would not agree to

renegotiate if this lowers her utility. Like in the existing literature on career concerns, however, the manager cannot committ not to withdraw her human capital if she gets a better outside offer. This is equivalent to say that human capital is inalienable.[3] This assumption is critical because it contribute to make the horizon of the project non-contractible.

At the end of the first period, when the first period output is realized and agents can update their beliefs, the manager can unilaterally 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 remuneration that matches her outside offer in expected value (if this is optimal for the current employer).

For simplicity I focus on compensation contracts that yield to the manager a fraction of the output if the project succeeds: $w_t^c = \beta_t^c x_t$, where c is the horizon of the contract, and t the date at which compensation actually accrues to the manager.

The horizon of the contract may be either long-term (l) or short-term (s). A long-term contract between a manager and a firm is signed at $t = 0$ and specifies compensation at $t = 1$ and $t = 2$. A short-term contract can be signed at $t = 0$ ($t = 1$), and specifies compensation at the end of the first (second) period.

Finally, I assume that there is a given set of managers, but the number of firms is potentially unlimited. This implies that there is competition among firms to attract managerial talent. Therefore at $t = 0$ the optimal contract maximizes the manager's lifetime expected utility, under the participation constraint of firm investors, who are assumed to be risk neutral and, differently from the manager, have a discount rate equal to zero.

III Short-term optimal contracts

A short-term contract is signed at date $t = 0$ ($t = 1$), and compensates the manager for the output realized at date $t = 1$ ($t = 2$). Under a short-term contract, the manager receives a bonus at the end of the period. Managerial compensation does not depend on future output or expectations of

[3] This assumption requiring that the manager cannot committ to slavery is a realistic representation of the labor market, similar to Hart and Moore (1994). As I show later, in this context, renegotiation happens in equilibrium because differently from Hart and Moore there is uncertainty on the realization of the signal and the future cash flow.

future output. In other words, the manager is not awarded stocks in the company. Nonetheless, the manager internalizes that the choice of investment horizon affects her second period remuneration because it influences her reputation. Therefore, I solve the model backward. All proofs of formal results are in the Appendix.

In the second period, the manager chooses between working for a new firm and continuing to work for the first period employer. New employers can only offer the manager a short-term contract. The optimal contract offered by a new employer solves the following problem:

$$\max_{\beta_2^{s\prime}} \beta_2^{s\prime} E_1(x_2|y, \widehat{h}_1, h_2 = s) \tag{2}$$

subject to the the investors' participation constraint:

$$\left(1 - \beta_2^{s\prime}\right) E_1(x_2|y, \widehat{h}_1, h_2 = s) - \frac{I}{2} \geqslant 0. \tag{3}$$

Note that the expected output depends on the horizon of the project (h_2), which is always short if the manager switches firm, on the signal of managerial ability observed at the end of the first period (y), and on the beliefs on the probability that a manager switching firm has undertaken a long-term project in the first period, $\widehat{h}_1 \in [0, 1]$. The signal and the beliefs on the probability that the manager has undertaken a short-term project affect investors' expectations on the managerial ability and ultimately the compensation of the manager. The horizon of the project can differ in the first and the second period because the manager has the option to switch firm and interrupt a long-term project.

Lemma 2 *In the optimal contract,* $\beta_2^{s\prime} = \frac{E_1(x_2|y,\widehat{h}_1,h_2=s)-\frac{I}{2}}{E_1(x_2|y,\widehat{h}_1,h_2=s)}$.

I denote with β_2^s the contract that the firm in which the manager is employed in the first period (first-period firm) offers to the manager in the second period. In the second period, the manager continues to work for the first period firm only if this ensures at least the same expected payoff of

working for an outside employer. The participation constraint of the manager at the begining of the second period can be written as follows:

$$\beta_2^s E_1(x_2|y, h_1, h_2) \geqslant \beta_2^{s'} E_1(x_2|y, h_1, h_2 = s), \tag{4}$$

The constraint (4) varies depending on the realization of the signal y and on the first period choice of investment horizon, which is private knowledge of the manager. First, consider the case in which $h_1 = s$. This implies that $h_2 = s$ even if the manager continues to work for the first period employer. Hence, the first period employer is able to retain the manager only if it offers a contract that gives her the same utility of the outside firms. The surplus from investment will have to be completely transferred to the manager if she is to be retained in the firm.

If the manager has chosen the long-term project in the first period, the first period firm has bargaining power deriving from the fact that the manager cannot work on a long-term project with a new employer. In the second period, the first period employer can thus offer a contract that satisfies (4) with the equality. Since the first period employer cannot observe the investment horizon h_1, satisfying (4) for $h_1 = h_2 = s$ implies that (4) is not binding for $h_1 = l$.

By retaining a manager working on a short term project, the firm obtains a payoff of zero because competition from new employers ensures that the manager appropriates all surplus from the short-term project. This makes the firm indefferent beween continuing to employ a manager with a short-term project, going out of production or hiring a new manager. Hence if the first period employer offered a contract that satisfies (4) for $h_1 = h_2 = s$, it would forgive some of the rents from the long-term project without enjoying any rents from the short-term project. This clearly cannot be optimal. Since the firm's payoff is not affected by losing the manager if she is working on a short-term project, in order to maximize the expected rent, the first period employer offers a contract that is equivalent to retain the manager only if she is working on a long-term project. A manager who has chosen a short-term project at $t = 0$ voluntarily switches to a new employer. This result can be summarized in Lemma 3.

Lemma 3 *The first period firm offers a contract that makes the manager indifferent beween continuing to work for the first period firm and switching to a new employer if she has undertaken a long-term project. Hence,(4) is binding for $h_1 = l$. Managers working on a short-term project switch employer (in other words, in the optimal contract, (4) is not satisfied for $h_1 = s$).*

In equilibrium, the manager is never compensated for having undertaken a long-term project. A manager who has undertaken a short-term project changes firm and new emplyers correctly anticipate this ($\widehat{h}_1 = 0$), while managers who continue to work for the first period employer are indifferent between doing so or switching to a new firm.

At $t = 0$ the manager anticipates that in the second period she will not be able to enjoy the higher payoff generated by a long-term project. From the assumptions in Subsection II.D, it follows that she has an incentive to undertake a short-term project in order to influence positively the expectations on her ability.

Hence no manager has ever an incentive to undertake a long-term project. This first result can be synthesized in Proposition 1.

Proposition 1 *No manager has an incentive to undertake a long-term project if she is offered a sequence of two short-term contracts.*

Surprisingly, a manager may have an incentive to choose a long-term project if she is expected to do so with probability zero, for instance because no long-run growth opportunities are expected to be available. In this case the manager would be offered the same contract in the second period by the current employer and the market. She would be able to choose to remain with the current employer to benefit from the long-term investment. It is important to stress however that such an equilibrium may be sustainable only if investors have wrong and overly pessimistic expectations on the available project opportunities. In this case, the first period employer does not extract the surplus produced by a long-term project because it believes that no long-term project is available.

Such an equilibrium may be available under more general conditions if firing a manager involves a cost, c.

The strategy described in Lemma 3 would imply the following payoff for the firm: $-(1-\phi)\,c+$ $\phi\left[E_1\left(x_2|y,\widehat{h}_1,h_2=l\right)-E_1\left(x_2|y,\widehat{h}_1,h_2=s\right)\right]$,

if the manager undertakes a long-term project when available.

The firm may have an incentive to offer a contract that leaves the manager a rent if she has undertaken a long-term project and leaves her indifferent whether to undertake a short term project at the current employer or at a new firm. In this case, the first period employer payoff is:

$\phi\left(1-\beta_2^s\right)\left[E\left(x_2|y,\widehat{h}_1,h_2=l\right)-E\left(x_2|y,\widehat{h}_1,h_2=s\right)\right]$.

This is an equilibrium if

$$\phi\beta_2^s\left[E\left(x_2|y,\widehat{h}_1,h_2=l\right)-E\left(x_2|y,\widehat{h}_1,h_2=s\right)\right]\leq(1-\phi)\,c \tag{5}$$

From (5), it is clear that in the intermediate period the firm is more likely to have an incentive to leave the manager rent from the long-term project if:

1. If the probability that a long-term project is available (ϕ) is small;
2. If the cost of managerial turnover (c) is large,
3. The smaller is the difference between the expected payoff of a short-term and a long-term project.

The manager actually undertakes the long-term project when available if the expected rent it can enjoy in the second period compensates her for the lower reputation she expects to accumulate. A sufficient condition for this to happen is that:

$$\frac{E_0\left[E_1(x_2|y,\widehat{h}_1,h_2=s)|h_1=l\right]-\frac{I}{2}}{E_0\left[E_1(x_2|y,\widehat{h}_1,h_2=s)|h_1=l\right]}\left(\overline{a}_0+l\right)> \tag{6}$$

$$> \frac{E_0\left[E_1\left(x_2|y,\widehat{h}_1,h_2=s\right)|h_1=s\right]-\frac{I}{2}}{E_0\left[E_1\left(x_2|y,\widehat{h}_1,h_2=s\right)|h_1=s\right]}\left(\overline{a}_0+s\right)$$

The beliefs of potential employers are denoted like before by $\widehat{h}_1$. Proposition 2 gives conditions under which a long-term project is actually chosen in equilibrium.

Proposition 2 *If changing manager after the first period involves a cost, c, for the firm, in equilibrium the manager may choose a long-term project even if she is offered a short-term contract at $t = 0$. This equilibrium is more likely to be achieved if growth opportunities ϕ are low, if l is significantly larger than s, if $a_H - a_L$ is small and if $\nu\lambda_H + (1-\nu)\lambda_L$ is not too different from $\nu\sigma_H + (1-\nu)\sigma_L$.*

If there are some costs of turnover for the company, the manager may find it optimal to choose the efficient long-term project even if she is offered a short-term contract at $t = 0$. This happens if the firm does not have an incentive to offer a second period short-term contract that does not completely expropriate the manager of the long-term project surplus. This is the case, in turn, if the firm expects that a long-term project is available with low probability. In this case, the firm expects that the manager will quit with high probability and it is better off matching the offer of other potential employers by offering the same share of the output, in order to avoid the expected cost of managerial turnover.

Whether long-term projects are implemented when firms offer short-term contracts may depend on the business cycles, which affect the probability that long-term growth opportunities are available (ϕ). Short-term contracts may not be sufficient to give managers incentives to choose the most profitable projects if growth opportunities are expected to be high. Additionally, the incentives of the manager to undertake the long-term project matter. Provided that growth opportunities (cost of turnover) are sufficiently low (high) that the first period employer has an incentive to offer the same contract of an external firm, inequality (6) is satisfied only if the expected payoff of a long-term project is expected to be sufficiently larger than the payoff of a short-term project to

compensate for the lower reputation that a manager undertaking a short-term project expects to earn. Additionally, the cost in terms of reputation is expected to be larger if ability has a large effect on the expected outcome.

Differences in transparency also affect the equilibrium as is described in Corollary 1.

Corollary 1 *As transparency increases, the manager is less likely to choose the long-term project if* $\nu\lambda_H + (1-\nu)\lambda_L << \nu\sigma_H + (1-\nu)\sigma_L$

Hence, contracts that subordinate managerial compensation on long-term performance may thus be necessary to maximize the return on investment if transparency improves.

Finally, Corollary 2 shows that firms cannot increase turnove costs using severance payments.

Corollary 2 *The equilibrium described above cannot be reached with a severance payment.*

IV Long-term optimal contracts

The previous Section shows that short-term contracts may not provide sufficiently strong incentives to undertake a long-term project. This is more likely if growth opportunities are perceived to be high or if the ability of the manager is observed with high probability. This Section studies under what conditions a long-term contract can give the manager incentives to undertake the long-term project. Since I want to focus on a situation where the long-term project cannot be implemented with a short-term contract, I assume that the cost of replacing a manager in the intermediate period is equal to zero.

As Fudenberg Holmström, and Milgrom (1989) point out, in this context, long-term contracts may be valuable because they provide the principal (i.e., firm shareholders in my model) the commitment to offer a given share of second period profits, which would not be offered in the intermediate period otherwise.

At $t = 0$, the firm solves the following problem:

$$\max_{\beta_1^l, \beta_2^l} E_0(w_1^c) + \delta E_0(w_2^c)$$

subject to

$$\beta_1^l pX + \delta\left(\beta_2^l E_0\left(x_2|y, h_1 = l, h_2 = l\right) + E_0\left(R|h_1 = l\right)\right) \geq \tag{7}$$

$$\geq \beta_1^l pX + \delta(\beta_2^l E_0\left(x_2|y, h_1 = s, h_2 = s\right) + E_0\left(R|h_1 = s\right));$$

$$(1-\beta_1^l)pX + \left(1-\beta_2^l\right)\left(\phi E_0\left(x_2|h_1 = l\right) + (1-\phi)E_0\left(x_2|h_1 = s\right)\right) - E_0(R) - I \geq 0. \tag{8}$$

The incentive-compatibility constraint (7) requires that at $t = 0$ the manager has an incentive to undertake the long-term project if available. Even though the firm offers a long-term contract at $t = 0$, the manager may choose to renegotiate the contract unilaterally if an outside offer guarantees a higher expected payoff than complying to the current contract. Hence (7) must take into account that with some probability the manager renegotiates the long-term contract in the intermediate period: R denotes the manager's renegotiation gain. The constraint (8) is the firm's participation constraint. The outside offer of a new employer in the second period continues to be described by Lemma 2.

Lemma 4 *The manager renegotiates if* $\beta_2^l E_1\left(x_2|Y, h_1, h_2\right) < \beta_2^{s'} E_1\left(x_2|Y, h_1, h_2 = s\right).$

The manager is more likely to renegotiate if no long-term project is available or if the signal of ability is positive as in this case she receives a better outside offer $\beta_2^{s'} = \frac{E_1\left(x_2|y,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y,\widehat{h}_1,h_2=s\right)}$. If the manager renegotiates the current employer gives an offer that leaves a manager who has undertaken a long-term project indifferent between quitting and continuing to pursue the long-term project. In equilibrium, managers who have undertaken a short term project quit. Hence, all new potential employers expect that no manager has undertaken a long-term project: $\widehat{h}_1 = 0$.

Lemma 5 *In an optimal long-term contract, the incentive compatibility constraint (7) is binding. The contract is renegotiated in at least some states of the world.*

Note that however a long-term contract cannot be renegotiated in all states of the world because in this case it would be equivalent to a sequence of two short-term contracts and the incentive-compatibility constraint would not be satisfied.

Proposition 3 *In the optimal contract, the deferred compensation is increasing in the level of transparency, ξ.*

Proposition 4 *A long-term contract is always feasable and optimal if*
$\frac{E_0\left(x_2|y,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_0\left(x_2|y,\widehat{h}_1,h_2=s\right)}\frac{(\overline{a}_0+s)}{(\overline{a}_0+l)} \leq \frac{E_1\left(x_2|y=B,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=B,\widehat{h}_1,h_2=s\right)}$.
Otherwise the long-term contract is feasable if
$$\phi\left(l-s\right)X \geq \left(1-\phi\right)E_0\left[\max\left\{\beta_2^l E_1\left(x_2|y,\widehat{h}_1,h_2=s\right)-E_1\left(x_2|y,\widehat{h}_1,h_2=s\right)+\tfrac{I}{2},0\right\}\right].$$

The first condition stated in Proposition 4 requires that a manager who has undertaken a short-term project always wants to renegotiate her contract even after a bad signal when she is offered the lowest share of the output.

The condition is satisfied if the difference $l-s$ is relatively large. The contract is always feasable because the firm does not have to leave rents to the CEO if she has undertaken a short-term project. Undertaking a long-term project allows compensation in both the first and the second period to increase. The long-term contract is thus preferable to the short-term contract.

If the long-term contract must leave a rent to the manager when she undertakes a short-term project, the expected gain from offering a long-term contract and implementing a long-term project must be larger than the expected loss. Otherwise the contract is not feasable. If the long-term contract is feasable, it is always optimal if the first period compensation does not decrease below $pX-\frac{I}{2}$. This is always true as long as: $\beta_2^l \leq 1$. Hence a long-term contract is optimal as long as ϕ is sufficiently large.

If the manager undertakes the long-term project, when this is available, the expected return to investment is higher and both short and long-term compensation are higher than in similar

companies that offer short-term contracts. This is consistent with the empirical evidence showing that there is a positive correlation between absolute level of compensation and long-term incentives (Murphy, 1999 and Towers Perrin, 2002).

Additionally, the empirical implications are compatible with the findings of Kole (1997). Managers in research-intensive firms, which are more likely to have long-term investment opportunities, receive equity-based awards that are more restrictive (e.g., stocks have longer time to full vesting) than in less innovative firms. Put differently, long-term incentives are stronger in sectors with high growth opportunities, such as the high-tech, than in more traditional sectors, such as utilities.

Proposition 3 and 4 have also implications for how contracts should vary over the business cycles, when growth opportunities are expected to be weaker: In the optimal contract, β_2^l is larger when transparency, ξ, is higher. In these instances, the long-term contract is more expensive because it implies a larger rent for the CEO when she undertakes a short-term project (because no long-term project is available). Hence if expectations of growth opportunities weaken, it may become optimal to give the manager only short-term incentives. This empirical implications can help explain the results of Banerjee, Gatchev and Noe (2004) who find that in the U.S., after the Enron collapse, when investors undoubtly revised downward expectations on future growth opportunities, only the most visible companies dropped option compensation.

The model also implies that managers should receive a larger proportion of long-term compensation when carrer concerns become stronger. This can explain why the increase in external hires of CEOs in the U.S. has been accompanied by an increase in the proportion of long-term compensation. It can also explain the empirical evidence showing that older managers receive less long-term incentives (Brian, Hwang and Lilien, 2000). Clearly, older CEOs having weaker carreer concerns have a stronger incentive to undertake the efficient project.

A Unrestricted stocks

So far I have assumed that the share of second period output the manager is awarded cannot be traded at $t = 1$. In this respect, the interpretation is that the manager is awarded restricted stocks or options on future output that cannot be transferred.

It is interesting to analyze whether and to what extent it may be convenient to award the manager a right to enjoy a share of the second period cash flow which includes the possibility of selling the right before the second period. To put it differently, I want to ask whether it can ever be optimal to award shares or options that the manager has the possibility to sell or exercise at $t = 1$.

I indicate with β_2^{tl} the right to enjoy the corresponding share of second-period cash-flows with the possibility of selling the stocks at time t. Hence, $\beta_2^{1l} > 0$ implies that the manager is awarded non-restricted stocks; β_2^{2l} must be interpreted as the restricted stocks in the previous Subsection.

In this Subsection, I analyze whether and under which conditions, it may be optimal to award non-restricted rights to second period cash flows in an optimal contract. First, β_2^{1l} is optimally set equal to zero if $\frac{E_1(X_2|Y,h_1=h_2=l)}{1+\delta} < E_1(X_2|y, h_1 = h_2 = l)$. In this case, even if the manager has undertaken a long-term project and the sale of stocks revealed to market participants that the horizon of the project is short (and therefore the expected value of the second period output relatively low), the manager would sell the right to enjoy the second period output in the intermediate period because she is very impatient. Hence, setting $\beta_2^{1l} > 0$ would have no impact on the incentive-compatibility constraint. It would be equivalent to have a larger β_1^l and $\beta_2^{1l} = 0$.

In what follows, I assume that the price is not revealing and that the manager's trade is anonymous. Therefore, it does not reveal the horizon of the project that has been undertaken. This is the case if a market for the firm stocks is available in the intermediate period and market participants revise their expectations on the second period output on the basis of the only information that is revealed in the first period, the first period output and the signal on managerial ability.

Furthermore, I assume that $\frac{E_1(X_2|Y,h_1=h_2=l)}{1+\delta} > E_1(X_2|y, \widehat{h}_1, h_1 = h_2 = l)$. This implies that a manager does not sell her stocks if she has undertaken a long-term project. Note that, in this case , unrestricted stocks help to keep the manager on the incentive compatibility constraint as β_2^{2l} contributes to increase the sensitivity of her compensation to the long-term project's second period cash flow.

Proposition 5 *Grants of non restricted rights to second period output are optimal if growth opportunities* $\phi \leq \lambda^{IC}(\delta)$.

Proposition 4 shows that there are situations in which it may be optimal to let the manager unwind equity incentives. Hence granting non-restricted stocks or options is not necessarily evidence that compensation reflects managerial power. The model gives an explanation alternative to Bolton, Scheinkman and Xiong (2003) of the reasons why it may be optimal to let the manager cash out at least some of the vested stocks or options. In Bolton, Scheinkman and Xiong (2003), some shareholders profit from the temporary overvaluation of stocks because there are other market participants with overoptimistic expectations on the prospect of the company. Hence, they give the manager an incentive to build "castles in the air", leading to a higher stock price in the short-term. I show that shareholders may find it optimal to award non-restricted stocks - even though they can give an incentive to profit from temporary overvaluation of stocks - *also when* they want to give an incentive to undertake a long-term project.

V Empirical evidence

In the previous section, I argue that a contract in which the CEO is allowed to enjoy rents (eventually disjoint from performance) if she remains with the same firm may be optimal in more transparent countries (where more firm specific information is produced).

It is challenging to test these implications because there exist no datasets providing information on CEO compensation outside the U.S. In many countries, the only information available to shed some light on these issues is the one voluntary provided by companies in their annual reports. In order to evaluate whether the factors suggested by the model affect CEO contracts in different cou

ntries, I have collected information on CEO contracts for the largest companies in 20 industrial countries.[4] For each of these countries, I have attempted to gather information for the 50 largest companies for stock market capitalization. Some of the companies however have not been included in the sample because their company reports could not be located or provided too little information. I define a company to provide long-term incentive if in the section on managerial compensation is mentioned that the company grants its executives non-vested stock options with vesting period of

[4]The sample includes Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Great Britain, Greece, Ireland, Israel, Italy, Japan, South Korea, Luxembourgh, the Netherlands, Norway, New Zealand, Sweden and , the U.S.

at least three years, out-of-the-money stock options, restricted stocks or other long-term incentive plans. The company is considered not to provide long-term incentives otherwise.

To distinguish across firms operating in more or less transparent environments, I need a proxy for how accurate firm specific information is produced in different financial markets. Morck, Yeung and Yu (2000) construct a measure of stock return synchronicity, using the average R^2 of firm-level regressions of bi-weekely stock returns on local and U.S. market indexes in each country. This measure captures that in countries with low stock return syncronicity more firm-specific information is produced. This involves that more information about managerial ability is widely available and, as I argue in the model, it may affect managerial contracts.

Finally, I match the information on CEO compensation with firm level information from OSIRIS, a dataset containing information on listed companies distributed by Bureau Van Dijk. I proxy for growth opportunities using the market to book ratio. From Osiris, I also obtain information on firm market capitalization, and ownership structure.

Table 1 shows the percentage of companies providing long-term incentives in countries with high and low level of transparency. As the model would predict long-term compensation is more likely to be used in countries where more firm-specific information is available even though growth opportunities are similar for companies in the two groups of countries. Companies in highly transparent countries are also less likely to have a principal shareholder who controls at least 30 per cent of the capital. The difference in ownership structure –even though less pronounced than the difference in the use of long-term compensation– could contribute to explain differences in managerial contracts. In firms where a controlling shareholders monitor professional managers or are directly involved in management, there might be less need to align mananagerial incentives with high powered contracts.

Table 2 reports some preliminary results from multivariate analysis. The estimates provide support for the model: Companies with high growth opportunities –as measured by the market-to-book ratio– appear to provide more long term incentives in countries where more firm specific information is produced. This is true even if I control for ownership concentration. As expected. however, companies with controlling shareholders give less long-term compensation suggesting that

agency problems are less severe.

VI Conclusions

This paper shows how expectations of high growth opportunities can exacerbate agency problems in an environment where the productivity of CEOs is likely to be observed by outsiders. The optimal contract has to change dramatically to give the manager an incentive to exploit the available growth opportunities. Short-term contracts that compensate managers with a bonus for past achievements are no longer sufficient to give an incentive to undertake the long-term efficient project. Long-term contracts, which subordinate managerial compensation to long-term performance, become optimal. Large differences in absolute compensation may arise between CEOs who are remunerated only for short-term performance and CEOs who are remunerated also for long-term performance.

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A Appendix

A Proof of Lemma 1

To prove Lemma 1, note that

$$E_0\left[E_1\left(a|y,\widehat{h}_1,h_2=s\right)|h_1=s\right]=$$
$$=(1-\xi)\overline{a}_0+\xi\left[\begin{array}{c}(\sigma_H\nu+\sigma_L(1-\nu))E_1\left(a|y=G,\widehat{h}_1\right)+\\((1-\sigma_H)\nu+(1-\sigma_L)(1-\nu))E_1\left(a|y=B,\widehat{h}_1\right)\end{array}\right].$$

$E_0\left[E_1\left(a|y,\widehat{h}_1,h_2=s\right)|h_1=l\right]$ is written analogously

Hence $\frac{\partial E_0\left[E_1\left(a|y,\widehat{h}_1,h_2=s\right)|h_1=s\right]-E_0\left[E_1\left(a|y,\widehat{h}_1,h_2=s\right)|h_1=l\right]}{\partial\xi}=$

$$=[\sigma_H\nu+\sigma_L(1-\nu)-\lambda_H\nu-\lambda_L(1-\nu)]E_1\left(a|y=G,\widehat{h}_1\right)-$$
$$-[(1-\lambda_H)\nu+(1-\lambda_L)(1-\nu)-(1-\sigma_H)\nu-(1-\sigma_L)(1-\nu)]E_1\left(a|y=B,\widehat{h}_1\right)=$$
$$=\alpha\left[E_1\left(a|y=G,\widehat{h}_1\right)-E_1\left(a|y=B,\widehat{h}_1\right)\right]>0.$$

B Proof of Lemma 2

It follows immedially from the maximization of $\max_{\beta_2^{s\prime}}\beta_2^{s\prime}E_1(x_2|y,\widehat{h}_1,h_2=s)$ under the constraint $\left(1-\beta_2^{s\prime}\right)E_1(x_2|y,\widehat{h}_1,h_2=s)-\frac{I}{2}\geqslant 0$.

C Proof of Proposition 2

The equilibrium described in Proposition 2 exists if inequalities (5) and (6) are both satisfied.

Inequality (5) is clearly more likely do be satisfied if ϕ is small. Similarly, (6) is more likely to be satisfied if l is relatively larger than s in roder to compensate the lower share of the output the manager expects to receive in the second period if she undertakes the long-term project. Inequality (6) is also more likely to be satisfied if

$$\frac{\frac{E_0\left[E_1\left(x_2|y,\widehat{h}_1,h_2=s\right)|h_1=s\right]-\frac{I}{2}}{E_0\left[E_1\left(x_2|y,\widehat{h}_1,h_2=s\right)|h_1=s\right]}}{\frac{E_0\left[E_1(x_2|y,\widehat{h}_1,h_2=s)|h_1=l\right]-\frac{I}{2}}{E_0\left[E_1(x_2|y,\widehat{h}_1,h_2=s)|h_1=l\right]}} \tag{9}$$

is not too large.

It is easy to show that the denominator is smaller (the numerator larger) if $\nu\sigma_H + (1-\nu)\sigma_L$ $((1-\lambda_H)\nu + (1-\lambda_L)(1-\nu))$ is smaller (larger). Additionally, if $a_H - a_L$ is small the difference between the expected ability after a good and a bad signal is also smaller and so (9) is.

Note that in equilibrium any manager who changes firm is extected to have undertaken a short-term project with probability 1 in the first period.

D Proof of Corollary 1

As ξ goes up the left hand side grows less than the right hand side if

$$\frac{\frac{I}{2}}{E_0\left[E_1(x_2|y,\widehat{h}_1,h_2=s)|h_1=l\right]^2}\left[\begin{array}{c}(\nu\lambda_H+(1-\nu)\lambda_L)\,E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)+\\((1-\lambda_H)\,\nu+(1-\lambda_L)\,(1-\nu))\,E_1\left(x_2|y=0,\widehat{h}_1,h_2=s\right)-\overline{a}_0\end{array}\right]*$$

$$*\frac{(\overline{a}_0+l)}{(\overline{a}_0+s)}<$$

$$<\frac{\frac{I}{2}}{E_0\left[E_1(x_2|y,\widehat{h}_1,h_2=s)|h_1=s\right]^2}\left[\begin{array}{c}(\nu\sigma_H+(1-\nu)\sigma_L)\,E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)+\\(1-\sigma_H)\,\nu+(1-\sigma_L)\,(1-\nu)\,E_1\left(x_2|y=0,\widehat{h}_1,h_2=s\right)-\overline{a}_0\end{array}\right]$$

which is satisfied if $\nu\lambda_H + (1-\nu)\lambda_L$ is sufficiently smaller than $\nu\sigma_H + (1-\nu)\sigma_L$.

E Proof of Corollary 2

The severance payment affects the manager decision whether to stay with the first period employer as follows:

$\beta_2^s E_1(x_2|y,h_1,h_2) \geqslant \beta_2^{s\prime} E_1(x_2|y,h_1,h_2=s)+c$. Hence it weakens the manager's incentive to undertake a long-term project by increasing the payoff from swithcing firm.

A manager who is working on a short-term project either leaves and receives c or receives an expected compensation which is c larger by the current employer and stays. Assume that $\beta_2^s = \beta_2^{s\prime}$. Then a manager working on a short-term project leaves while a manager working on a long-term project continues to work for the same firm if $\beta_2^s E_1(x_2|y,h_1=l,h_2=l) > \beta_2^{s\prime} E_1(x_2|y,h_1,h_2=s)+c$. It would be optimal to decrease β_2^s so that $\beta_2^s E_1(x_2|y,h_1=l,h_2=l) = \beta_2^{s\prime} E_1(x_2|y,\widehat{h}_1,h_2=s)+c$, because this would increase the payoff if the manager is working on a long-term project without decreasing the payoff if the manager is working on a short-term project. Hence $\beta_2^s = \beta_2^{s\prime}$ cannot be

optimal.

The first period employer may alternatively offer a contract that retains the manager in all states of the world, by offering $\beta_2^s E_1(x_2|y,h_1,h_2) \geqslant \beta_2^{s\prime} E_1(x_2|y,h_1,h_2=s)+c$. But this would yield a lower payoff than the previous strategy because the first period employer would have a payoff of $-c$ if the manager is working on a short-term project and a lower payoff than in the previous case if the manager is working on a long-term project.

Hence the optimal contract must be such that the manager cannot appropriate the extra rent produced by a long-term project. As before the manager would have an incentive to choose the short-term project. A severance payment weakens the manager's incentive to undertake a long-term project without giving the firm an incentive to share the extra surplus created by a long-term project.

F Proof of Lemma 4

First note that since the manager has larger utility from the first period than from the second period compensation. Hence, where possible, her compensation should be anticipated to the first period.

Second if the manager never renegotiates the contract, the incentive compatibility constraint (7) can be written as: $\beta_2^l E_0\left(x_2|y,h_1=l,h_2=l\right) \geq \beta_2^l E_0\left(x_2|y,h_1=s,h_2=s\right)$, which is always strictly satisfied because $E_0\left(x_2|y,h_1=l,h_2=l\right) > E_0\left(x_2|y,h_1=s,h_2=s\right)$. Hence the incentive compatibility constraint is not binding. It would thus be possible to anticipate some of the compensation without changing the manager's incentives to undertake the long-term project and increasing her utility. Hence in an optimal long-term contract, the incentive-compatibility constraint must be binding and is renegotiated in at least some states of the world.

G Proof of Proposition 3

As argued in Lemma 4, the incentive-compatibility constraint must be binding. Otherwise it would be possible to increase managerial utility by anticipating managerial compensation. The incentive-compatibility constraint can be binding, only if the long-term contract is renegotiated at least in

some states of the world.

Depending on parameter values, the optimal contract can be renegotiated in different states of the world. In what follows, I consider all possible cases, and show that deferred compensation is always increasing in ξ.

Case 1: The manager renegotiates the optimal contract when she undertakes the short-term project.

In this case the constraint (7) can be rewritten as:

$\beta_2^l\left(\overline{a}_0+l\right)\geq$

$\geq\frac{E_0\left(x_2|y,\widehat{h}_1,h_1=h_2=s\right)-\frac{I}{2}}{E_0\left(x_2|y,\widehat{h}_1,h_2=s\right)}\left(\overline{a}_0+s\right).$

To show that the right-hand side increases in ξ, it is sufficient to show that $\frac{\partial E_0\left(x_2|y,\widehat{h}_1,h_2=s\right)}{\partial\xi}>0$. In order to do so, note that:

$E_0\left(x_2|y,\widehat{h}_1,h_1=h_2=s\right)=\xi\left(\nu\sigma_H+(1-\nu)\sigma_L\right)E_1\left(x_2|y=G,\widehat{h}_1,h_1=h_2=s\right)+$

$+\xi\left(\nu\left(1-\sigma_H\right)+\left(1-\nu\right)\left(1-\sigma_L\right)\right)E_1\left(x_2|y=B,\widehat{h}_1,h_1=h_2=s\right)+\left(1-\xi\right)\overline{a}_0.$

Hence $\frac{\partial E_0\left(x_2|y,\widehat{h}_1,h_2=s\right)}{\partial\xi}=\left(\nu\sigma_H+(1-\nu)\sigma_L\right)E_1\left(x_2|y=G,\widehat{h}_1,h_1=h_2=s\right)+$

$+\left(\nu\left(1-\sigma_H\right)+\left(1-\nu\right)\left(1-\sigma_L\right)\right)E_1\left(x_2|y=B,\widehat{h}_1,h_1=h_2=s\right)-\overline{a}_0>$

$\left[\widehat{h}_1\left(\lambda_H\nu+\lambda_L\left(1-\nu\right)\right)+\left(1-\widehat{h}_1\right)\left(\nu\sigma_H+(1-\nu)\sigma_L\right)\right]E_1\left(x_2|y=G,\widehat{h}_1,h_1=h_2=s\right)+$

$+\left[\begin{array}{c}\widehat{h}_1\left(\left(1-\lambda_H\right)\nu+\left(1-\lambda_L\right)\left(1-\nu\right)\right)+\\ \left(1-\widehat{h}_1\right)\left(\nu\left(1-\sigma_H\right)+\left(1-\nu\right)\left(1-\sigma_L\right)\right)\end{array}\right]E_1\left(x_2|y=B,\widehat{h}_1,h_1=h_2=s\right)-\overline{a}_0=0$

Case 2: The manager renegotiates the optimal contract when she undertakes the short-term project and there is no bad signal.

In this case the constraint (7) can be rewritten as:

$\beta_2^l\left(\overline{a}_0+l\right)\geq\left(1-\xi\right)\frac{E_1\left(x_2|y=\varnothing,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=\varnothing,\widehat{h}_1,h_2=s\right)}\left(\overline{a}_0+s\right)$

$+\xi\left(\nu(1-\sigma_H)+(1-\nu)(1-\sigma_L)\right)\beta_2^l E_0\left(x_2|y=B,h_1=s,h_2=s\right)+$

$+\xi\left(\nu\sigma_H+(1-\nu)\sigma_L\right)\frac{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)}E_0\left(x_2|y=G,h_1=s,h_2=s\right).$

The derivative of the right-hand side with respect to ξ:

$\left(\nu(1-\sigma_H)+(1-\nu)(1-\sigma_L)\right)\beta_2^l E_0\left(x_2|y=B,h_1=s,h_2=s\right)+$

$+\left(\nu\sigma_H+(1-\nu)\sigma_L\right)\frac{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)}E_0\left(x_2|y=G,h_1=s,h_2=s\right)-$

$-\left(\overline{a}_0+s-\frac{I}{2}\right)>$

$$(\nu(1-\sigma_H)+(1-\nu)(1-\sigma_L))\left(E_0\left(x_2|y=B,h_1=s,h_2=s\right)-\tfrac{I}{2}\right)+$$
$$+\left(\nu\sigma_H+(1-\nu)\sigma_L\right)\left(E_0\left(x_2|y=G,h_1=s,h_2=s\right)-\tfrac{I}{2}\right)$$
$$-\left(\overline{a}_0+s-\tfrac{I}{2}\right)=0$$

Case 3: The manager renegotiates the optimal contract when she undertakes the short-term project and there is a good signal.

In this case the constraint (7) can be rewritten as:

$$\beta_2^l\left(\overline{a}_0+l\right)\geq$$
$$\left(1-\xi\left(\left(\nu\sigma_H+(1-\nu)\sigma_L\right)\right)\right)\left(\beta_2^l E_0\left(x_2|y\neq G,h_1=s,h_2=s\right)\right)+$$
$$+\xi\left(\nu\sigma_H+(1-\nu)\sigma_L\right)\frac{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)}E_1\left(x_2|y=G,h_1=s,h_2=s\right)$$

The right-hand side is clearly increasing in ξ.

Case 4: The manager always renegotiates after a good signal.

In this case the constraint (7) can be rewritten as:

$$\left(1-\xi\left(\nu\lambda_H+(1-\nu)\lambda_L\right)\right)\beta_2^l E_0\left(x_2|y\neq G,h_1=l,h_2=l\right)+$$
$$+\xi\left(\nu\lambda_H+(1-\nu)\lambda_L\right)\left(\frac{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)}E_1\left(x_2|y=G,h_1=s,h_2=s\right)\right)\geq$$
$$\left(1-\xi\left(\nu\sigma_H+(1-\nu)\sigma_L\right)\right)\beta_2^l E_0\left(x_2|y\neq G,h_1=s,h_2=s\right)+$$
$$+\xi\left(\nu\sigma_H+(1-\nu)\sigma_L\right)\frac{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)}E_1\left(x_2|y=G,h_1=s,h_2=s\right),$$

which can be rewritten as:

$$\beta_2^l\left(E_0\left(x_2|y\neq G,h_1=l,h_2=l\right)-E_0\left(x_2|y\neq G,h_1=s,h_2=s\right)\right)+$$
$$+\xi\left(\nu\lambda_H+(1-\nu)\lambda_L\right)\left(\begin{array}{c}\frac{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)}E_1\left(x_2|y=G,h_1=s,h_2=s\right)-\\-\beta_2^l E_0\left(x_2|y\neq G,h_1=l,h_2=l\right)\end{array}\right)\geq$$
$$\geq\xi\left(\nu\sigma_H+(1-\nu)\sigma_L\right)\left(\begin{array}{c}\frac{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)}E_1\left(x_2|y=G,h_1=s,h_2=s\right)-\\-\beta_2^l E_0\left(x_2|y\neq G,h_1=s,h_2=s\right)\end{array}\right),$$

where

$$\left(\nu\lambda_H+(1-\nu)\lambda_L\right)\left(\begin{array}{c}\frac{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)}E_1\left(x_2|y=G,h_1=s,h_2=s\right)-\\-\beta_2^l E_0\left(x_2|y\neq G,h_1=l,h_2=l\right)\end{array}\right)<$$
$$<\left(\nu\sigma_H+(1-\nu)\sigma_L\right)\left(\begin{array}{c}\frac{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)}E_1\left(x_2|y=G,h_1=s,h_2=s\right)-\\-\beta_2^l E_0\left(x_2|y\neq G,h_1=s,h_2=s\right)\end{array}\right).$$

Hence the constraint becomes more binding as ξ increases.

Case 5: The manager always renegotiates if she has undertaken a short-run project, but renegotiates only after a good signal if she has undertaken a long-run project.

In this case the constraint (7) can be written as:

$$\begin{aligned}
&\left(1-\xi\left(\nu\lambda_H+(1-\nu)\lambda_L\right)\right)\beta_2^l E_0\left(x_2|y\neq G,h_1=l,h_2=l\right)+\\
&+\xi\left(\nu\lambda_H+(1-\nu)\lambda_L\right)\frac{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)}E_1\left(x_2|y=G,h_1=s,h_2=s\right)\geq\\
&\geq\frac{E_0\left(x_2|y,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_0\left(x_2|y,\widehat{h}_1,h_2=s\right)}\left(\overline{a}_0+s\right)X=\\
&=\left(1-\xi\left(\nu\sigma_H+(1-\nu)\sigma_L\right)\right)\frac{E_0\left(x_2|y\neq G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_0\left(x_2|y\neq G,\widehat{h}_1,h_2=s\right)}E_0\left(x_2|y\neq G,h_1=s,h_2=s\right)+\\
&+\xi\left(\nu\sigma_H+(1-\nu)\sigma_L\right)\frac{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)}E_1\left(x_2|y=G,h_1=s,h_2=s\right)
\end{aligned}$$

For given β_2^l that satisfies the constraint with the equality, an increase in ξ increases the right-hand side fasterthan the left hand side.

Case 6: The manager renegotiates only after a good signal if she has undertaken a long-run project, but also after no signal if she has undertaken a short-run project.

In this case the constraint (7) can be written as:

$$\begin{aligned}
&\left(1-\xi\left(\nu\lambda_H+(1-\nu)\lambda_L\right)\right)\beta_2^l E_0\left(x_2|y\neq G,h_1=l,h_2=l\right)+\\
&+\xi\left(\nu\lambda_H+(1-\nu)\lambda_L\right)\left(\frac{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)}E_1\left(x_2|y=G,h_1=s,h_2=s\right)\right)\geq\\
&\left(1-\xi\right)\left(\overline{a}_0+s-\tfrac{I}{2}\right)+\\
&+\xi\left(\nu(1-\sigma_H)+(1-\nu)(1-\sigma_L)\right)\beta_2^l E_0\left(x_2|y=B,h_1=s,h_2=s\right)+\\
&+\xi\left(\nu\sigma_H+(1-\nu)\sigma_L\right)\frac{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=G,\widehat{h}_1,h_2=s\right)}E_0\left(x_2|y=G,h_1=s,h_2=s\right).
\end{aligned}$$

The derivative of the right hand side with respect to ξ is now larger than in case 5, while the left hand side is the same as in case 5. Hence case 5 implies case 6.

Case 7: The manager always renegotiates with the exception of the case in which she has undertaken a long-run project and there is a bad signal.

In this case the constraint (7) can be written as:

$$\begin{aligned}
&\left(1-\xi\left(\nu(1-\lambda_H)+(1-\nu)(1-\lambda_L)\right)\right)\left(\frac{E_1\left(x_2|y\neq B,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y\neq B,\widehat{h}_1,h_2=s\right)}E_1\left(x_2|y\neq B,h_1=s,h_2=s\right)\right)+\\
&+\xi\left(\nu(1-\lambda_H)+(1-\nu)(1-\lambda_L)\right)\beta_2^l E_0\left(x_2|y=B,h_1=l,h_2=l\right)\geq\\
&\geq\frac{E_0\left(x_2|y,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_0\left(x_2|y,\widehat{h}_1,h_2=s\right)}\left(\overline{a}_0+s\right)
\end{aligned}$$

An increase in ξ increases the right-hand side (as has been proved in case 1), but decreases the left hand side. This proves that the constraint becomes more binding as ξ increases.

H Proof of Proposition 4

Consider the case in which a CEO who has undertaken a short-term project always renegotiates the contract and leaves. In this case, the firm expects a payoff of 0 with probability $1-\phi$. With probability ϕ, the firm has a rent in the second period that can transfer to the manager at $t=0$. Hence the firm always break even and the contract is feasable.

A CEO who has undertaken a short-term contract always renegotiates the contract and leaves only in case 1 of Proposition 3. Hence from the incentive compatibility constraint: $\beta_2^l = \frac{E_0\left(x_2|y,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_0\left(x_2|y,\widehat{h}_1,h_2=s\right)}\frac{(\overline{a}_0+s)}{(\overline{a}_0+l)}$. The manager does not actually have an incentive to renegotiate if, as stated in Proposition 3, $\frac{E_0\left(x_2|y,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_0\left(x_2|y,\widehat{h}_1,h_2=s\right)}\frac{(\overline{a}_0+s)}{(\overline{a}_0+l)} \leq \frac{E_1\left(x_2|y=B,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y=B,\widehat{h}_1,h_2=s\right)}$, where the right-hand side is the share of the output that the manager receives if she switches company after a bad signal (the lowest possible $\beta_2^{s'}$).

From the point of view of the CEO the contract is preferable to a short-term contract because the long-term contract allows the CEO to have a compensation which is at least as large as the short-term contract in the second period. Additionally, since the long-term contract produces an expected rent for the firm in the second period the CEO compensation in the first period can increase above the one of the short-term contract.

If the previous condition is not satisfied, in some states of the world, the CEO does not renegotiates the long-term contract when she has undertaken the short-term project. In this case, with probability $1-\phi$, the CEO is left a rent in the second period and the firm expects a loss. For ϕ small, this implies that the firm expected loss in the second period may be larger than the expected gain from a long-term project. Hence the manager compensation in the first period has to decrease below the level of the short-term contract. In this case, since the manager is impatient ($\delta \leq 1$), the long-term contract is not optimal. It may also be not feasable if the β_2^l satisfying the incentive-compatibility constraint does not satisfy the investors' participation constraint even when the first period compensation is zero (a non feasable contract is clearly not optimal while the contrary is not necessarily true).

The long-term contract is also optimal if the discounted increase in second period compensation is larger than the eventual decrease in the first period compensation. A necessary and sufficient condition for this to happen is the following:

$\delta\phi\left(l-s\right)X > pX - \frac{I}{2} - \left(pX - \frac{I}{2} + \left(1-\beta_2^l\right)\left(\phi(l+\overline{a}_0) + \left(1-\phi\right)\left(s+\overline{a}_0\right)\right)X\right).$

The previous inequality requires that the expected increase in the second period utility allowed by the long-term contract is larger than the decrease in second period compensation. This condition is always satisfied if $\beta_2^l \leq 1$.

I Proof of Proposition 5

First note that it makes sense to grant non restricted rights to second period output (instead of increasing the first period compensation) only if these help to relax the incentive-compatibility constraint. This is the case if the manager keeps the unrestricted rights to second period output when she has undertaken a long-term project. In turn, the manager has an incentive to do so if she does not find it optimal to sell the rights to the second period output and renegotiate the compensation for the second period. This implies that the following constraint must be satisfied at $t=1$ for any realization of the signal y:

$\left(\beta_2^{1l} + \beta_2^{2l}\right) E_1\left(x_2|y, h_1 = h_2 = l\right) \geq \frac{E_1\left(x_2|y,\widehat{h}_1,h_2=s\right)-\frac{I}{2}}{E_1\left(x_2|y,\widehat{h}_1,h_2=s\right)} E_1\left(x_2|y, h_1 = h_2 = s\right) + \beta_2^{1l} E_1\left(x_2|y,\widehat{h}_1,h_2\right)\left(1+\delta\right).$

This constraint is more stringent when $y = G$. This implies that I can consider only one constraint.

Solving for the optimal contract implies to find $\beta_1^{1l}, \beta_2^{1l}, \beta_2^{2l}$ which maximize the expected utility:

$E_0(U) = \beta_1^l E_0(X_1) + \phi(\beta_2^{1l} + \beta_2^{2l})\frac{E_0(X_2|y,h_1=h_2=l)}{1+\delta} + (1-\phi)\beta_2^{1l} E_0(X_2) + (1-\phi)\beta_2^{2l}\frac{E_0(X_2|y,h_1=h_2=s)}{1+\delta} +$
$+ \frac{E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)\right)}{1+\delta}$

under the previous constraint and the participation and incentive-compatibility constraints which are respectively:

$(1-\beta_1^l)E_0(X_1) + (1-\beta_2^{1l}-\beta_2^{2l})E_0(X_2) - E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)\right) = 0$

$(\beta_2^{1l}+\beta_2^{2l})E_0(X_2|y,h_1=h_2=l) + E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)|h_1=l\right) >$

$\beta_2^{1l}E_0(X_2)\left(1+\delta\right) + \beta_2^{2l}E_0(X_2|y,h_1=h_2=s) + E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)|h_1=s\right).$

The first order conditions of the previous program with respect to β_2^{1l} and β_2^{2l} are respectively:

$$\phi\frac{E_0(X_2|y,h_1=h_2=l)}{1+\delta}+(1-\phi)E_0(X_2)+\frac{1}{1+\delta}\phi\frac{\partial E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)|h_1=l\right)}{\partial\beta_2^{1l}}-\lambda^{PC}\left[E_0(X_2)-\frac{1}{1+\delta}\phi\frac{\partial E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)|h_1=l\right)}{\partial\beta_2^{1l}}\right]+$$
$$+\lambda^{IC}\left[\frac{E_0(X_2|y,h_1=h_2=l)}{1+\delta}+\frac{1}{1+\delta}\frac{\partial E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)|h_1=l\right)}{\partial\beta_2^{1l}}-E_0(X_2)\right]+$$
$$+\lambda^{III}\left[E_1\left(x_2|y,h_1=h_2=l\right)-E_1\left(x_2|y\right)(1+\delta)\right]\geq 0$$

$$\phi\frac{E_0(X_2|y,h_1=h_2=l)}{1+\delta}+(1-\phi)\frac{E_0(X_2|y,h_1=h_2=s)}{1+\delta}+\frac{1}{1+\delta}\left[\phi\frac{\partial E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)|h_1=l\right)}{\partial\beta_2^{2l}}+(1-\phi)\frac{\partial E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)|h_1=s\right)}{\partial\beta_2^{2l}}\right]-$$
$$-\lambda^{PC}\left[E_0(X_2)-\frac{1}{1+\delta}\frac{\partial E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)\right)}{\partial\beta_2^{1l}}\right]+$$
$$+\lambda^{IC}\frac{1}{1+\delta}\left[E_0(X_2|y,h_1=h_2=l)+\frac{\partial E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)|h_1=l\right)}{\partial\beta_2^{2l}}-E_0(X_2|y,h_1=h_2=s)-\frac{\partial E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)|h_1=s\right)}{\partial\beta_2^{2l}}\right]+$$
$$+\lambda^{III}E_1\left(x_2|y,h_1=h_2=l\right)\geq 0$$

It is optimal to set $\beta_2^{1l}>0$ if the first first order condition is larger than the second:

$$(1-\phi)\left[E_0(X_2)-\frac{E_0(X_2|y,h_1=h_2=s)}{1+\delta}\right]-\frac{(1-\phi)}{1+\delta}\left(1+\lambda^{PC}\right)\frac{\partial E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)|h_1=s\right)}{\partial\beta_2^{2l}}-$$
$$-\lambda^{IC}\left[E_0(X_2)-\frac{E_0(X_2|y,h_1=h_2=s)}{1+\delta}-\frac{1}{1+\delta}\frac{\partial E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)|h_1=s\right)}{\partial\beta_2^{2l}}\right]-\lambda^{III}\left[E_1\left(x_2|y\right)(1+\delta)\right]\geq 0$$

The proportion of unresticted rights to second period output is determined in a straigthforward way if the (new) constraint is binding as $\beta_2^{1l}$and β_2^{2l} are determined solving the system of the new constraint and the incentive compatibility constraint. It implies that as growth opportunities are perceived to improve the optimal share of unrestricted rights to second period output decreases (because $E_1\left(x_2|y\right)$ increases, while the incentive compatibility constraint is not affected by ϕ).

Now consider the case in which the new constraint is not binding. In this case, $\lambda^{III}=0$.

Since $\frac{\partial E_0\left(R\left(\beta_2^{1l},\beta_2^{2l}\right)|h_1=s\right)}{\partial\beta_2^{2l}}\leq 0$, the previous inequality is always satisfied if $(1-\phi)\geq\lambda^{IC}$. With some tedious algebra, it is possible to prove that λ^{IC} increases as managers become more impatient ($\delta\uparrow$). In fact, the utility from second period compensation decreases and it becomes more costly to compensate the manager with unrestrcited shares which require a larger compensation than restricted rights to second period output in the second period to satisfy the incentive compatibility constraint. It follows that the previous inequality is more likely to be satisfied if δ and ϕ are relatively small.

Table 1 Descriptive statistics

A country is defined to have high level of transparency if the index of price synchronicity of Morck et al. (2000) is below the median in sample countries. Long-term compensation is the percentage of companies which award executives non-vested stock options with vesting period of at least three years, out-of-the-money stock options, restricted stocks or other long-term incentive plans. Controlling shareholder is the percentage of companies where one shareholder directly or indirectly controls at least 30 percent of the capital. Market to book and market capitalization are the average of the market-to-book ratio and the firm market capitalization. Transparency is the inverse of Morck et al. (2000) price synchronicity index.

	High transparency	Low transparency
Long-term compensation	50	18
Controlling shareholder	63	67
Market-to-book ratio	1.435	1.441
Market capitalization (th. USD)	5256	18200
Transparency	17.53	6.54
No. Obs.	518	492

Table 2 The determinants of long-term compensation

The dependent variable is a dummy that takes value 1 if the company awards executives non-vested stock options with vesting period of at least three years, out-of-the-money stock options, restricted stocks or other long-term incentive plans, and 0 otherwise. All other variables are defined in Table 1. The marginal effects of the variable indicated in the first column (t-statistics) are presented.

	Regression 1
Transparency* Market-to-book ratio	0.038 (2.15)
Transparency	0.3 (6.15)
Market-to-book ratio	(-0.13) (-0.47)
Log of Market Capitalization	0.09 (9.54)
Controlling shareholder	-.13 (-3.47)