Dipartimento di Scienze Economiche
Università degli Studi di Firenze

Working Paper Series

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C. Graziano and A. Luporini

Working Paper N. 05/2010
March 2010

Dipartimento di Scienze Economiche, Università degli Studi di Firenze
Via delle Pandette 9, 50127 Firenze, Italia
www.dse.unifi.it

Stampato in proprio in Firenze dal Dipartimento Scienze Economiche
(Via delle Pandette 9, 50127 Firenze) nel mese di March 2010,
Esemplare Fuori Commercio Per il Deposito Legale
agli effetti della Legge 15 Aprile 2004, N.106

Optimal Delegation when the Large Shareholder has Multiple Tasks*

Clara Graziano†, Annalisa Luporini‡

March, 2010

Abstract

The paper analyzes the optimal delegation and ownership structure in a setting where the owner of a firm hires a manager to run the firm and to gather information on investment projects. The initial owner has two tasks: monitoring the manager and supervising project choice. Profits depend on both tasks and optimality would require different ownership stakes. A large stake is necessary for monitoring while a small stake is necessary for not interfering with incentives for project choice. Allocating control rights over project choice to the manager can alleviate this conflict. Delegation is optimal despite dissonant preferences, if managerial private benefits are not too small. By delegating authority over project choice and by using an optimal compensation scheme, the large shareholder is able to retain full ownership of the firm and, at the same time, to provide strong incentives to the manager. However, full ownership comes at the price of distorting monitoring and the resulting firing policy. Severance pay plays a key role in the optimal compensation scheme. We interpret delegation as the choice of a dual-board structure where the supervisory board is in charge of monitoring and management board is in charge of project selection.

JEL classification: G34, L22

Keywords: Large Shareholder, Concentrated Ownership, Delegation, Monitoring, Board of directors, Corporate Governance.

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*We would like to thank Bruno Parigi for helpful comments and suggestions.

†Dipartimento di Scienze economiche, Università di Udine, via Tomadini 30, 33100, Udine, Italy, e-mail: Clara.Graziano@dse.uniud.it

‡Dipartimento di Scienze economiche, Università di Firenze, Via delle Pandette 9, 50127 Firenze, Italy, e-mail: luporini@unifi.it

1 Introduction

The board of directors performs several tasks. The board oversees the hiring and firing of top executives and in general it has a disciplinary role. At the same time, it also has an advising role and helps to set the strategy of the firm. Each role, in turn, is a combination of several tasks. For example Adams, Hermalin and Weisbach (2008) point out that the assessment of top executives has two components: monitoring what top management does and determining the intrinsic ability of top management. The advising role instead involves communication and information transmission between management and directors in order to select the best strategy.

It is well known that in a multi-task environment, the incentive to induce an agent to perform one task may conflict with the incentive to perform another task. A possible solution to incentive conflicts is represented by an appropriate allocation of tasks among the agents. Aghion and Tirole (1997) have shown that a principal may profitably delegate formal or real authority to an agent in order to mitigate his own incentive to interfere with the agent's decision (which would reduce the incentives for the agent). In the present paper we study a problem of allocation of control rights over tasks between the initial owner of a firm and the management. The initial owner has to perform two tasks: elaborating the strategy of the company (project selection) and monitoring/firing the manager. The incentives required by the two tasks conflict each other because too high a level of monitoring discourages the manager from exerting effort to gather information that is needed for project choice. We suggest that delegating the elaboration of company's strategy to the management may be optimal because it alleviates this incentive conflicts. In our setting, the initial owner decides the optimal ownership structure and hires a manager to run the firm and to gather information on investment projects. She also decides whether to retain the authority to choose the investment project or to delegate it to the manager. Owner's and manager's preferences over projects are divergent because of managerial private benefits. At the same time the owner has to monitor the manager to find out his ability in order to decide whether to fire or retain him.

Profit depend on both tasks and optimality would require different ownership stakes: a large stake is required for monitoring but a small stake is necessary for not interfering with the proposed strategy. We show that by delegating authority over project choice and by using an optimal compensation scheme, the large shareholder is able to retain full ownership of the firm (high incentive for monitoring) and, at the same time, to encourage information gathering from the manager.

When project choice is delegated to the manager, full ownership of the firm is optimally retained by the initial owner but monitoring and the resulting firing decision are somewhat distorted. Monitoring intensity in fact is highest when the initial owner retains the authority to select the project. This happens because monitoring has a twofold effect. A high monitoring intensity increases the probability of replacing a low-ability manager, thus increasing profits. However, by increasing the firing probability, it also reduces managerial effort in information gathering. As a consequence, the initial owner reduces monitoring in order to provide the proper incentive to the manager and this effect is more important when the manager has the crucial task of elaborating the company's strategy.

Managerial discretion in project selection (i.e., delegation) and monetary compensation (incentive pay and severance pay) coexist in the optimal contract and complement each other in providing incentives to the manager. Severance pay is an important component of the contract because of the conflict between the firing policy (dependent on monitoring) and the need to provide incentives to the manager. Severance pay alleviates this conflict by (partly) insulating the manager from the negative consequences of being fired without entrenching him. A noteworthy feature of the optimal contract is that, under delegation, severance pay is higher than incentive pay. In other words, when fired a (low-ability) manager receives a higher payment than when he is confirmed because he must be compensated for the loss of private benefits. Delegation in fact allows the manager to choose his preferred project and hence to enjoy private benefits when he is retained by the firm.

We interpret the delegation of authority over elaborating company's strategy

as the choice of a dual-board structure where the management board (in charge of project selection), is separated from the supervisory board controlled by the large shareholder (in charge of monitoring and firing/retention decision). Contrary to what happens in public companies with dispersed ownership, in companies with concentrated ownership there often is an 'excessive' involvement of owners in the management of the firm rather than lack of monitoring. Owner's activism is common in Continental Europe and more generally in countries with concentrated ownership (see, e.g. Faccio and Lang, 2002). Indeed, recent empirical studies on corporate governance have suggested that the presence of an active large shareholder is much more common than previously thought (see, among others, La Porta et al., 1999, and Holderness, 2009). The policy implication of our model is that a dual-board structure can be a useful device to alleviate the problem of excessive interference of the large shareholder without reducing the fraction of retained shares.

Our framework is similar to that of Burkart, Gromb and Panunzi (1997) who show that a large shareholder actively involved in a firm's management may reduce managerial discretion and prevent the manager from appropriating private benefits. However, large shareholder activism interferes with the need to motivate the manager to take initiative and make uncontractible investments. The authors suggest that the ownership structure can be used to solve this conflict: a reduction in the large shareholder's stake can limit her incentive to exercise control rights. In their model the large shareholder has only one task (interfering with project choice)[1]. Then, one instrument (the ownership structure) is sufficient to alleviate the incentive conflict. In our model instead, the large shareholder has two tasks (interfering with project choice and monitoring the manager). As a consequence, more instruments must be used to provide proper incentives. Furthermore, we show that using a plurality of instruments allows

[1] Burkart, Gromb and Panunzi, call 'monitoring' such activity of project choice supervision, because in their model there is no role for managerial quality. In our model, on the contrary, we have both a problem of opposite preferences over projects and a problem of discovering the unknown ability of the CEO. Thus, in line with previous models of board behavior (see for example Hermalin and Weisbach (1998), Hirshleifer and Thakor (1998)) we use the word monitoring to indicate the activity of the large shareholder aimed at discovering the ability of the manager in order to decide whether to retain or to fire him.

the initial owner to retain full ownership of the firm. Indeed, if incentive compensation cannot be used for some reason (see extension A), delegation requires the initial owner to sell a positive fraction of shares .

Our paper is also related to the scant literature on multitasking in boards. Most of the fast-growing literature on boards has analyzed various aspects of a single task, trying to assess if the board accomplishes it effectively. For example, several papers study optimal board composition from the shareholders' point of view (see Harris and Raviv 2006, Raheja 2005, Warther 1998 among others). Other papers instead examine the determinants of CEO and directors appointment (Hermalin and Weisbach 1998 and 2003, Hermalin 2005). In general, little attention has been paid to tasks interaction. The few exceptions we are aware of are Adams and Ferreira (2008), Dominguez-Martinez, Swank and Visser (2008) and Graziano and Luporini (2003). Adams and Ferreira study the trade-off between the advisory and the decision making roles of the board. They show that these two functions may conflict: the CEO may refrain from sharing his information with the board because he fears that this information may be used to interfere in decision making. Thus, it may be desirable to separate these functions in two different boards. Dominguez-Martinez, Swank and Visser consider the twin tasks of disciplining and screening the CEO and they show that a tension between these two functions arises when the CEO cares about his career. They examine the trade-off between discouraging executives from becoming too active (empire building) and maximizing the probability that the executive is competent. As a result the link between bad performance and dismissal is weakened. Graziano and Luporini focus on the same conflict between CEO selection and CEO dismissal in a setting where the dismissal/retention decision provides information both on the quality of the CEO and on the ability of the board. Since firing the CEO indicates that his selection was wrong in the first place, the board may try to hide its inability in the selection of the CEO by distorting the second task (CEO retention/dismissal decision).

The rest of the paper is organized as follows. Section 2 presents the basic model. Section 3 anticipates some basic features of managerial compensation

and delegation. The choice of monitoring intensity by the large shareholder is analyzed in Section 4, while Section 5 illustrates the choice of effort by the manager. Section 6 examines the choice of the optimal contract and of the ownership structure by the large shareholder. Section 7 presents three extensions of the basic model and finally Section 8 discusses the results and illustrates how delegation can be interpreted in terms of a dual board structure.

2 The model

Consider a firm initially owned by a single owner (she) who needs to hire a manager (he) of unknown ability. The manager is needed both to run routine activities and to collect information on prospective new projects. Depending on the delegation structure, such information can be used either by the owner or by the manager himself to select a project. Project choice cannot be verified by third parties; thus the owner cannot contract directly on such choice. There are two types of manager: high-ability (H) and low-ability (L). The ability of the manager depends on the quality of the matching between his skills and the skills required by that particular firm. As a consequence, the manager himself is not aware of his type when joining the firm, and no screening is possible. Only after the manager has spent some time on the job, can the owner assess his ability through monitoring and decide whether to fire or retain him. Both the owner and the manager are risk-neutral. The latter has a reservation level of utility equal to zero and is protected by limited liability.

Our model develops over four periods. In period 1, the owner decides the fraction α of shares she wants to retain, $(1 \geq \alpha > 0)$ and makes a take-it-or-leave-it contract offer to a manager, randomly selected from a given pool where the fraction of high-ability managers is λ, with $0 < \lambda < 1$. The remaining shares, if any, are sold to dispersed shareholders who do not play any active role in firm management. We then refer to the initial owner as the 'large shareholder'. The contract $C = \left\langle d, w, s, P^F(\widehat{t}) \right\rangle$ offered to the manager specifies the delegation structure d, the compensation w, the severance pay s, and the firing rule $P^F(\widehat{t})$

where $\widehat{t} = \widehat{H}, \widehat{L}$, is the manager type reported by the large shareholder. $d \in \{0, 1\}$ where $d = 0$ indicates that the large shareholder retains the authority to choose the investment project and $d = 1$ indicates that project choice is delegated to the manager.[2] For simplicity, the firing rule is expressed in terms of the firing probability $P^F(\widehat{t})$ because, as it will be shown later, the optimal values of $P^F(\widehat{t})$ are either 0 or 1. Given that the firing/retention decision is observable and verifiable, it can be part of the contract.

In period 2, the manager can exert effort in order to obtain information about projects, and, based on such information, the firm (either the large shareholder or the manager himself, depending on the chosen value of d) may decide to undertake a risky project in addition to 'business as usual'. The firm's returns from business as usual are verifiable and depend on manager's type. Returns are $\overline{\pi} > 0$ if the manager is high-ability, and are $\underline{\pi} = 0$ if the manager is low-ability. Recalling that the manager is randomly chosen and that λ is the fraction of high-ability managers, the expected return from routine activity is $\lambda\overline{\pi}$. As to investment projects, we assume that the firm can select one among $N \geq 3$ possible projects. However, only two projects are relevant: project 0 and project 1. These projects offer a positive and verifiable monetary return $R > 0$ with probabilities p_0 and p_1 respectively ($p_0 > p_1 > 0$), and zero return otherwise. To simplify matters we assume that project return is independent of manager type. The remaining $N - 2$ projects (indexed from 2 to $N - 1$) yield very negative returns with some probability so that randomly picking a project results in a negative expected return. Project 1 offers private benefits $b > 0$ to the manager implementing it. For technical reasons we assume that $b < \lambda\overline{\pi}(1 - \lambda) \equiv \beta$, that $\beta(2 + \lambda) < p_1 R < 2 - \beta$ and that $(p_0 - p_1)R < \beta$.[3]

In order to identify project 0 and project 1, information must be gathered by the manager. Gathering information requires unobservable effort $e \in [0, 1]$

[2] We could allow for d to be stochastic ($0 \leq d \leq 1$) but, as the large shareholder's problem would not be concave in d, the optimal solutions would still be corner ones. Thus, we simplify the exposition by directly presenting the two cases of $d = 0$ and $d = 1$.

[3] These assumptions ensure interior solutions for effort, ownership structure, incentive pay and monitoring thus simplifying the exposition. They also ensure that incentive compatibility conditions on s and w are satisfied. Results would not be affected by also considering corner solutions or binding constraints.

at cost $\frac{e^2}{2}$. A level of effort e implies that the manager is able to identify project 0 and 1 (and to distinguish between them) with probability e. With probability $1-e$ the manager does not obtain enough information and, given that random choice is unprofitable, no project is chosen. Thus e is the probability of undertaking a risky project. If the manager is in charge of project choice, he will use such information to choose his preferred project. If the large shareholder retains control over project choice, the manager will have to pass the information to her. We assume that the information is 'hard' meaning that the manager can either withhold information or pass it on truthfully. Furthermore, we assume that the large shareholder is able to correctly process the information obtained from the manager.[4]

In period 3, once effort has been exerted and (possibly) a risky project has been selected, the large shareholder can engage in monitoring. Monitoring is aimed at assessing the manager's type in order to decide whether to retain or to fire him. Recall that manager's ability positively affects the returns from routine activity so that replacing a low-ability manager with a high-ability one increases such returns. However monitoring is costly and its outcome is uncertain. A monitoring intensity $M \in [0,1]$ costs $M^2/2$ to the large shareholder and allows her to learn the manager's ability with probability M. With probability $1-M$ the large shareholder remains uninformed. Monitoring is uncontractible, so that there is no possibility to induce the large shareholder to increase monitoring intensity through payments contingent on it. Following monitoring, the large shareholder makes a report $\widehat{t}$ on the manager's type. Then, on the basis of this report and of the firing rule $P^F(\widehat{t})$ specified in the contract, the manager is either retained or fired. We assume that the managers' pool is large enough for the probability of a high ability replacement to remain λ. We also assume that there are no firing costs other than the severance pay and that, in the event of firing, the new manager cannot modify the investment project.

In period 4, cash flows are realized and payments are made. If project

[4] We assume that processing information as well as being in charge of project choice imposes no costs on the large shareholder. Including such a cost would insert an additional motive for delegation.

1 has been implemented and the incumbent manager has not been fired, the latter obtains private benefits b. In section 7 we extend the analysis to the case where private benefits are obtained before the possible firing decision, so that the incumbent manager always obtains b when project 1 is implemented.

Summarizing, timing is as follows:

period 1: The initial owner determines the optimal ownership structure, α and offers a contract $C = \left\langle d, w, s, P^F(\widehat{t}) \right\rangle$ to the manager.

period 2: The manager implements effort e and possibly a new investment project is chosen (by either the manager or the large shareholder).

period 3: The large shareholder exerts monitoring and learns manager's type with probability M. Then, she decides whether to retain or fire the manager.

period 4: Cash flow from routine activity and possibly from a risky project are obtained, together with private benefits if project 1 is selected. Payments are made.

We proceed by backward induction. However, since managerial compensation and delegation structure are determined only in Section 6 we anticipate in the next section their main characteristics that are crucial in understanding the following analysis.

3 Managerial Compensation and Delegation

In order to elicit the optimal level of effort from the manager, the large shareholder offers him an incentive contract. Manager's compensation can be conditioned on verifiable returns and on the firing decision, so that the manager may receive severance pay if fired. Given that the manager has no possibility to improve his (exogenously given) ability, and consequently cannot increase returns from routine activity, there is no point in conditioning managerial compensation on $\overline{\pi}$. Performance pay and possibly severance pay conditional on return R can instead be used to induce a greater effort from the manager. We then

consider compensations formed by a base salary, performance pay and severance pay. Given that the reservation utility of the manager is normalized to zero and that routine activity imposes no disutility on the manager, the base salary is equal to zero. Moreover, since the manager is protected by limited liability, we restrict our attention to compensation contracts that yield zero payment when the project's return is zero and a non-negative bonus when the project succeeds. The bonus is w if the manager is retained, and s if he is fired. In other words, also severance pay is contingent on project success. Recalling that in the event of firing the new manager cannot modify the investment project, no incentive compensation is paid to the replacement.

Incentive compensation however is not sufficient to solve the conflict of interests between the manager and the large shareholder. Recall that project 1 offers private benefits $b > 0$ to the manager implementing it. This, together with the assumption that $p_0 > p_1$, creates a conflict between the manager and the large shareholder because, everything else being equal, the former prefers project 1 and the latter, who is interested in monetary return, prefers project 0. Given that project choice in uncontractible, compensation cannot be contingent on project choice. As a consequence the delegation structure d is key to determining which project will be chosen. In case of delegation ($d = 1$), the manager will choose project 1, and in case of no delegation ($d = 0$) the large shareholder will choose project 0. Delegation can then be viewed as a commitment device for the large shareholder to implement project 1 in an incomplete contract environment.

4 Period 3: Monitoring and firing decision

In period 3, once the manager has exerted effort and a project has possibly been chosen, the large shareholder may find it optimal to monitor the manager in order to learn his type. Depending on the reported type and on the firing rule contained in the contract, the incumbent manager is then retained or replaced.

In the event of firing, the ability of the replacement is unknown at the

time he is hired. If a low-ability manager is replaced, there is an increase in expected returns from routine activity equal to $\lambda\overline{\pi}$. If instead a high-ability manager is replaced, there is an expected loss equal to $(1-\lambda)\overline{\pi}$. The optimal contract must then prescribe firing (retention) if low (high) ability is observed, i.e. $P^F(\widehat{L}) = 1$ and $P^F(\widehat{H}) = 0$. However, the decision of the large shareholder also depends on the difference between incentive pay w and severance pay s. In order to guarantee that the large shareholder has no incentive to misreport the manager's type given $P^F(\widehat{H}) = 0$ and $P^F(\widehat{L}) = 1$, w and s must satisfy the following two incentive compatibility conditions:

$$(1-\lambda)\overline{\pi} - p_i(w-s) \geq 0 \tag{1}$$

$$\lambda\overline{\pi} - p_i(s-w) \geq 0 \tag{2}$$

with $i = 0, 1$. The first condition guarantees that the gain in expected profit from retaining a high-ability manager, $(1-\lambda)\overline{\pi}$, is not offset by the difference between expected bonus if he is retained and severance pay if he is fired, $p_i(w-s)$. Similarly, the second condition guarantees that the gain in firing the low-ability type, $\lambda\overline{\pi}$, is not offset by the difference $p_i(s-w)$.

Consider now the optimal firing probability when monitoring is unsuccessful. If nothing is learnt from monitoring (which happens with probability $1-M$), there is no expected gain from replacing the manager because the expected profit from the incumbent is equal to the expected profit from a replacement. As a consequence the corresponding incentive compatible firing probability, $P^F(\widehat{0}) \equiv P^F$, will depend on the sign of $w-s$:

$$P^F \begin{cases} = 1 \ \text{ if } w > s \\ = 0 \ \text{ if } \ w < s \\ \in [0,1] \ \text{ if } w = s \end{cases} \tag{3}$$

The optimal values of w, s and P^F will be determined in Section 6. For the moment suffice it to note that the values of w, s and P^F contained in the contract satisfy conditions (1), (2) and (3) respectively.

Recalling that project 1 (project 0) is chosen under delegation (no delegation), the large shareholder chooses M to maximize her expected profits for

$d = 0, 1$:

$$\max_{M} \quad \alpha_d\{M\left[\lambda\overline{\pi} + (1-\lambda)\lambda\overline{\pi}\right] + (1-M)\lambda\overline{\pi}$$
$$+I_{pro}p_d\left[R - w_d(M\lambda + (1-P_d^F)(1-M)) - s_d(M(1-\lambda) + (1-M)P_d^F\right]\} - \frac{M_d^2}{2}$$

where $I_{pro} \in \{0, 1\}$ is an indicator function taking value 1 if a risky project has been selected and value 0 otherwise. From the first-order condition we obtain:

$$M_d = \alpha_d\left\{(1-\lambda)\left[\lambda\overline{\pi} + I_{pro}p_d(1-\lambda-P_d^F)(w_d - s_d)\right]\right\}. \tag{4}$$

Monitoring increases in the expected gain from replacing a bad with a good manager, $\lambda\overline{\pi}$, and in the fraction of shares owned by the large shareholder, α. Given that P^F must satisfy (3), the level of monitoring is the highest when a risky project is not undertaken ($I_{pro} = 0$) or if a a project is implemented with $w = s$. In such a case, monitoring intensity simplifies to:

$$M_d = \alpha_d(1-\lambda)\lambda\overline{\pi} \tag{5}$$

This high-lights one aspect of the conflict between monitoring and incentives for project choice. Whenever incentives for effort require to set $w \neq s$, the level of monitoring must be reduced with respect to (5) to preserve incentive compatibility in the firing decision.

5 Period 2: Managerial effort

In period 2, the manager decides the level of effort that maximizes his expected utility. If the large shareholder retains control rights on investment decision ($d = 0$), the manager knows that project 0 will be chosen and that he will only get monetary compensation. Under delegation ($d = 1$) instead he will be able to choose project 1 obtaining also private benefits b.

Recall that the manager does not know his own type when deciding the level of e. However, he can anticipate the value of M_d that will be chosen by the large shareholder in order to calculate the *ex ante* firing probability in case a

risky project is implemented,

$$F_d \equiv M_d(1-\lambda) + (1-M_d)P_d^F = P_d^F + M_d(1-\lambda-P_d^F), \qquad d = 0, 1. \quad (6)$$

The manager then solves:

$$\max_e \qquad e\{w_d p_d(1-F_d) + s_d p_d F_d + db(1-F_1)\} - \frac{e^2}{2} \qquad d = 0, 1$$

From the first order condition we obtain :

$$e_0 = p_0 \left[w_0(1-F_0) + s_0 F_0\right] \quad (7)$$

and

$$e_1 = p_1 \left[w_1(1-F_1) + s_1 F_1\right] + b(1-F_1) \quad (8)$$

Managerial effort is an increasing function of the expected value of monetary compensation and, in the case of delegation, of private benefits. As far as monetary compensation is concerned, the expectation is taken with respect to the probability of success conditional on project choice. For a given value of d, when the project succeeds, the bonus is w if the manager is confirmed (which happens with probability $1-F$). If the manager is fired (which happens with probability F) he gets severance pay s. Private benefits instead are obtained only under delegation and if the manager remains with the firm.

Monetary compensation and private benefits are substitutes with respect to managerial effort. As a consequence the large shareholder will choose the combination of w, s, and d that makes it cheaper to motivate the manager.

6 Period 1: Large Shareholder maximization problem

The objective of the large shareholder in period 1 is to maximize the equity value of the firm net of monitoring costs, i.e. the sum that she could raise by selling all the shares to dispersed shareholders. The large shareholder decides the optimal ownership structure α and the contract $C = \left\langle d, w, s, P_F(\widehat{t})\right\rangle$ she offers to the manager, anticipating how the subsequent choice of effort by the

manager, e_i, and her own choice of monitoring intensity M_i are influenced by these variables.

From Section 4 we know that $P^F(\widehat{H}) = 0$ and $P^F(\widehat{L}) = 1$ independently of the delegation structure, so that we are left with the determination of α, w, s, P^F and d. Since d is a discrete variable that can take only two values we solve the maximization problem of the large shareholder with respect to α, P^F, w and s for each value of d. Then, by comparing firm equity value with and without delegation, we determine the optimal d.

Using (4) for the value of M_d, the large shareholder solves the following maximization problem for $d = 0, 1$:

$$\underset{\alpha,w,s,P^F}{Max} \quad e_d p_i[R - w\,(1 - F_d) - sF_d] + \lambda\overline{\pi} + \tag{9}$$

$$e_d\{\lambda(1-\lambda)\overline{\pi}\alpha[(1-\lambda)\left[\lambda\overline{\pi} + p_d(1-\lambda-P^F)(w-s)\right] - \tag{10}$$

$$\frac{\{\alpha[(1-\lambda)\left[\lambda\overline{\pi} + p_d(1-\lambda-P^F)(w-s)\right]\}^2}{2}\} + \tag{11}$$

$$(1-e_d)[\alpha(1-\lambda)^2\lambda^2\overline{\pi}^2 - \frac{[\alpha(1-\lambda)\lambda\overline{\pi}]^2}{2}] \tag{12}$$

where e_0 is determined in (7), e_1 in (8), $w - s$ and P^F must satisfy (1), (2), (3).

The solution of the problem is characterized in the following Proposition.

Proposition 1. When the large shareholder retains control over project choice ($d = 0$), she optimally sets $w_0 = s_0 = \frac{R}{2}$ and $P_0^F \in [0, 1]$. When she decides to delegate project choice to the manager ($d = 1$), she optimally sets $w_1 = \frac{R}{2} - \frac{b+(1-\lambda^2)\lambda\overline{\pi}}{2p_1} + \frac{b^2(1-\lambda)(1+3\lambda)}{4p_1}$, $s_1 = w_1 + \frac{b}{(1-\lambda)p_1}$ and $P_1^F = 0$. Both under $d = 0$ and $d = 1$ she retains full ownership of the firm α_0=α_1= 1

Proof. See Appendix.

When the large shareholder finds it optimal to keep control over project choice ($d = 0$), returns from the project are equally shared between the manager and the large shareholder by setting the bonus equal to $\frac{R}{2}$ irrespective of the firing decision. As a consequence, the firing probability becomes irrelevant, $P_0^F \in [0, 1]$, and we can assume without loss of generality that the firing rule

inserted in the contract prescribes either $P_0^F = 0$ or $P_0^F = 1$. When the large shareholder delegates project choice to the manager ($d = 1$), monetary compensation is lower because the manager has positive expected private benefits. Moreover the level of the severance payment exceeds that of the incentive pay: $s_1 > w_1$. Now P_1^F must be equal to 0 in order for the contract to be incentive compatible. If P_1^F were positive, the large shareholder would in fact have an incentive to report high ability even when she has no information. Both under delegation and no delegation, the large shareholder retains full ownership of the firm, which enables her to maximize monitoring intensity. Note however that the realized level of monitoring depends on the delegation structure. By using Proposition 1 and substituting the values of w, s, P^F and α in expression (4) we obtain:

$$M_0 = (1 - \lambda)\lambda\overline{\pi}$$

$$M_1 = (1 - \lambda)[\lambda\overline{\pi} - b]$$

which, substituting into (6) , result in a lower level of the ex ante firing probability under delegation than under the authority of the large shareholder

$$F_0 = M_0(1 - \lambda) + (1 - M_0)P_0^F \geq (1 - \lambda)M_0 > (1 - \lambda)M_1 = F_1.$$

Monitoring intensity is highest when the large shareholder retains authority over project choice ($d = 0$). When instead project choice is delegated to the manager ($d = 1$), monitoring is reduced to decrease the ex ante firing probability F_1, and to increase the expected value of private benefits, $(1 - F_1)b$. The ex ante firing probability is optimally reduced to motivate the manager to exert effort since private benefits represent an incentive component obtainable only if the manager stays with the firm. In other words, when $d = 1$ there is a trade-off between routine profits that are increasing in monitoring and profits from the risky project that require a low monitoring. When $d = 0$ instead, there is no point in distorting monitoring because monetary compensation is independent of the firing policy: $w_0 = s_0$ and the manager receives no private benefits.[5] These results are summarized in the following proposition.

[5] In this case the *ex ante* firing probability depends on the chosen value of P_0^F . Given $w_0 = s_0$ the large shareholder is indifferent between retaining or firing the incumbent manager when monitoring is unsuccessful.

Proposition 2. When project choice is delegated to the manager, monitoring and the resulting ex ante firing probability are optimally reduced to provide the manager with the proper incentive to exert effort.

It is worth noting the role of severance pay in this incentive conflict. Severance pay, by providing a payment $s > w$, insulates the manager from the replacement policy, compensating him for the loss of private benefits. In fact when private benefits are unobtainable ($d = 0$) incentive pay and severance pay are equal. However, setting $s > w$ introduces a distortion in the level of monitoring and consequently in the firing probability which is reduced with respect to the case of no delegation. Notice that in the absence of severance pay, the only means to motivate the manager would be to reduce the firing probability. Other papers have shown that some degree of entrenchment may be optimal because the threat of being fired may lead to suboptimal managerial behavior.[6] In our paper, severance pay is important for the opposite reason: it allows the large shareholder to motivate the manager without distorting the firing policy too much. To a certain extent, in our model severance pay is a substitute for a more accommodating firing policy.

Having characterized the optimal contract with and without delegation, we now have determined if and when delegating project choice is profitable. First of all, by substituting condition (22) from the proof of Proposition 1 and $\alpha = 1$ in the net equity value of the firm (see the objective of the large shareholder) we obtain the following lemma.

Lemma 1. The net equity values of the firm without and with delegation can be expressed as:

$$\begin{aligned} V_0 &= (e_0)^2 + \lambda\overline{\pi} + \frac{(1-\lambda)^2\lambda^2\overline{\pi}^2}{2} \\ V_1 &= (e_1)^2 + \lambda\overline{\pi} + \frac{(1-\lambda)^2\lambda^2\overline{\pi}^2}{2} \end{aligned}$$

where $e_0 = p_0\frac{R}{2}$ *and* $e_1 = p_1\frac{R}{2} + \frac{b}{2}[1-(1-\lambda)^2(\lambda\overline{\pi}-b)] - \frac{(1-\lambda)^2b^2}{4}$.

[6] For example Almazan and Suarez (2003) have demonstrated that shareholders may gain by relinquishing some power in favour of the CEO. In their model, severance pay is an important instrument to this end because it reduces the probability of firing the manager.

This tells us that delegation is optimal if and only if the effort level obtained when $d = 1$ is higher than the effort level obtained when $d = 0$. By comparing e_0 with e_1 we can then establish conditions for delegation to be profitable.

Proposition 3. There exists a threshold value $\overline{b}$ such that for $b > \overline{b}$ the large shareholder prefers to delegate project choice ($d = 1$) and for $b < \overline{b}$ she prefers to keep control over it ($d = 0$). $\overline{b}$ is increasing in R and in the difference $p_0 - p_1$ so that high values of both make delegation less likely.

Proof: see Appendix.

Proposition 3 establishes a positive relationship between delegation and the level of private benefits. For sufficiently high level of b, project choice is delegated to the manager. In this case (see Proposition 1), monetary compensation is reduced in proportion to the level of expected private benefits. For low levels of b instead, the large shareholder finds it more profitable to keep control over project choice because the reduction in the expected return from the project under delegation (recall that the manager chooses project 1) is not compensated by the reduction in monetary compensation. In other words, the higher is b, the more profitable it is to substitute private benefits for monetary compensation in order to motivate the manager.[7] Given that $p_0 > p_1$, the threshold value $\overline{b}$ is increasing in R because so is the difference in expected returns from project 0 and 1. Obviously such difference is amplified by an increase in the difference $p_0 - p_1$, for any given R.

7 *Extensions*

In this section we present three extensions of the basic model. In the first one, we further explore the relationship between delegation, ownership and compensation policy by studying the limit case with no monetary compensation, i.e. with $w = s = 0$. In the second one, we examine a different timing that allows the manager to enjoy private benefits before the firing/retention decision. This

[7] Notice that for $b = 0$ the large shareholder is indifferent between $d = 0$ and $d = 1$ because the conflict of interests disappears. Even the manager now prefers to choose project 0 that has a higher probability of success.

modified timing eliminates the negative impact of monitoring on managerial effort. The third extension maintains this modified timing and exacerbates the conflict of interests between manager and large shareholder by allowing project 0 to yield private benefits to the large shareholder in addition to the higher return. This of course makes delegation less likely.

A. No monetary incentives

There may be situations in which monetary incentives cannot be paid because, for example, monetary return R is not verifiable. In the basic model, monetary compensation and delegation are alternatives methods of providing incentives. If we rule out monetary incentives, delegation is the only way to induce managerial effort and this obviously reinforces the optimality of delegation. It immediately follows from (7) that in the absence of monetary incentives, managerial effort is equal to zero when $d = 0$, and it is

$$e_{1|w=s=0} = b(1 - F_{1|w=s=0}) \tag{13}$$

when $d = 1$. Private benefits become now necessary for the manager to exert effort and consequently for a risky project to be chosen. Then the following proposition holds.[8]

Proposition 4. If no monetary compensation is available, i.e. if $w = s = 0$, *the threshold value is* $\bar{b}_{w=s=0} = 0$, *so that the large shareholder always chooses to delegate the manager* ($d = 1$) *when there are positive private benefits. The fraction of retained shares is strictly smaller than one,* ($\alpha_{1|w=s=0} = 1 - \frac{bRp_1}{\lambda\overline{\pi}}$) *and the firing probability when no information is revealed by monitoring is zero* ($P^F_{1|w=s=0} = 0$).

Proof. See Appendix.

Whenever $b > 0$ the large shareholder chooses delegation in order to have a positive probability of undertaking the risky project. The fraction of retained shares $\alpha_{1|w=s=0}$ is now lower than 1. The reason is that, once we exclude monetary compensation, the only way to reduce M_1 is to decrease the value of α.

[8] In the absence of monetary compensation, the condition $1 > Rp_1$ must be added to the other assumptions in order to ensure a positive level of α.

If α_1 were equal to 1, monitoring intensity, and consequently the ex ante firing probability F_1, would be too high from an incentive point of view because a high level of F_1 implies a relatively low level of effort (see (13)).

If $b = 0$, the large shareholder is indifferent as to the delegation structure because no risky project will be undertaken. In this case, she also retain full ownership of the firm in order to maximize monitoring and consequently profits from routine activity.

Given that $\alpha_{1|w=s=0} < 1$, a time consistency problem may arise. Once the manager has exerted effort and information on investment projects has been gathered, the large shareholder may have an incentive to buy back some shares thus increasing her stake. This would prompt an increase in monitoring intensity that would increase expected returns from routine activity without having negative effects on the (sunk) level of effort. The manager however, would anticipate the behavior of the large shareholder and would lower the effort level accordingly. In other words, the optimal contract illustrated in the above proposition would be destroyed. Fortunately it can be proved that the large shareholder has no incentive to retrade after date 1, provided that her stake is publicly observable.[9] In order to induce dispersed shareholders to sell their shares, the large shareholder has to offer a price that fully reflects the increase in the equity value of the firm. But if this is the case, she cannot gain by purchasing back the shares.

B. Manager's private benefits independent of monitoring

There may be cases where the manager has no need to stay for a long time with the firm in order to enjoy private benefits. For example, the benefits may consist of the increased visibility obtained by the announcement of the new project undertaken by the firm. The case where the firing/retention decision is taken after the manager has enjoyed private benefits can be represented by a change in the timing considered so far, such that in period 3 private benefits

[9] The proof is omitted because it parallels the argument provided in Proposition 4 by Burkart, Gromb and Panunzi (1997) to prove that the large shareholder does not have an incentive to renegatiate her effort.

(if any) from the risky project are realized; in period 4 the large shareholder implements monitoring and decides whether to confirm or fire the manager; and finally in period 5, routine and project's returns are realized.

When the large shareholder retains control over choice and selects project 0, no private benefits are generated. As a consequence, for $d = 0$, monitoring, effort and the contract offered by the large shareholder are the same as those analyzed in the basic model of Section 6. Under delegation, instead, effort choice is modified because b is now obtained with certainty when project 1 is selected. It can be easily verified that effort becomes

$$\widetilde{e}_1 = p_1[\widetilde{w}_1(1 - F_1) + \widetilde{s}_1 F_1] + b.$$

Then, the following proposition holds.

Proposition 5. If the manager is able to enjoy private benefits before the firing/retention decision, the large shareholder optimally sets $\widetilde{w}_0 = \widetilde{s}_0 = R/2$ *when she retains control over project choice (*$d = 0$*), and* $\widetilde{w}_1 = \widetilde{s}_1 = \frac{R}{2} - \frac{b}{2p_1}$ *when she delegates project choice (*$d = 1$*). The optimal value of* α *is independent of* d *and is always equal to* 1 *and* $\widetilde{P}^F \in [0, 1]$.

Proof: See Appendix.

If the manager is able to enjoy private benefits before the firing/retention decision, the incentive provided by delegation is stronger than in the basic model and this makes it cheaper to induce him to exert effort when $d = 1$. In this case, incentive pay is lower than in the basic model, $\widetilde{w}_1 < w_1$. Moreover, $\widetilde{s}_1 = \widetilde{w}_1$ because, in the event of firing, there is no need to compensate the manager for the loss of private benefits. Equality between incentive and severance pay implies that monitoring is independent of delegation and it is equal to monitoring intensity in the basic model without delegation: $\widetilde{M}_1 = \widetilde{M}_0 = M_0$. This in turn means that, under delegation, monitoring intensity is now higher: $\widetilde{M}_1 > M_1$. In the basic model, the firing decision (which positively depends on monitoring intensity) affects managerial choice of effort because it reduces the probability of enjoying private benefits. To contrast this effect, the large shareholder optimally chooses to increase severance pay above the level of w_1 in order to reduce

monitoring intensity and the *ex ante* firing probability. When the link between managerial incentive and monitoring is receded as in the present case, there is no need to reduce monitoring and the bonus paid if the project is successful does not depend on the firing decision, i.e. $\widetilde{s}_1 = \widetilde{w}_1$.

Considering that $\widetilde{e}_1 = p_1 R + \frac{b}{2}$, we immediately see that, when $d = 1$, effort is now higher than in the basic model. This implies that delegation becomes optimal for lower values of b as shown by the following proposition.

Proposition 6. If the manager is able to enjoy private benefits before the firing/retention decision, there exists a threshold value $\widetilde{b}$ such that for $b > \widetilde{b}$ the large shareholder prefers to delegate project choice ($d = 1$) and for $b < \widetilde{b}$ she prefers to keep control over it ($d = 0$). $\widetilde{b}$ is increasing in R, p_0, and decreasing in p_1. Moreover $\widetilde{b} < \overline{b}$.

Proof: See Appendix.

C. Large Shareholder Private Benefits

Suppose now that incongruence over projects is exacerbated by the presence of private benefits for the large shareholder associated with project 0, where B denotes these benefits. The expressions for monitoring and managerial effort are not affected by large shareholder's private benefits. Also the maximization problem under delegation is the same as in subsection B above. However, for $d = 0$ the large shareholder's problem becomes:

$$\underset{\alpha,w,s,P^F}{Max} \quad \widehat{e}_0[(R - w(1 - \widehat{F}_0) - s\widehat{F}_0)p_0 + B] + \lambda\overline{\pi} +$$

$$\widehat{e}_0\{\lambda(1-\lambda)\overline{\pi}\alpha[(1-\lambda)\left[\lambda\overline{\pi} + p_0(1 - \lambda - P^F)(w - s)\right]] - \tag{14}$$

$$\frac{\{\alpha[(1-\lambda)\left[\lambda\overline{\pi} + p_0(1 - \lambda - P^F)(w - s)\right]]\}^2}{2}\} + \tag{15}$$

$$(1 - e_0)[\alpha(1-\lambda)^2\lambda^2\overline{\pi}^2 - \frac{[\alpha(1-\lambda)\lambda\overline{\pi}]^2}{2}] \tag{16}$$

The solutions for α and w, s, and P^F lead to the following results.[10]

Proposition 7. If private benefits for the large shareholder are associated with project 0 and the manager is able to enjoy private benefits before the fir-

[10] In order to ensure an interior solution for e_0 we now assume $p_0 R + B < 2$.

ing/retention decision, the optimal value of α *is independent of* d *and always equal to* 1 *and* $\widehat{P}^F \in [0,1]$. *Incentive compensation is equal to* $\widehat{w}_0 = \widehat{s}_0 = \frac{R}{2} + \frac{B}{2p_0}$ *when* $d = 0$ *and to* $\widehat{w}_1 = \widehat{s}_1 = \frac{R}{2} - \frac{b}{2p_1} = \widetilde{w}_1$ *when* $d = 1$.

Proof: See Appendix.

When $d = 0$ the monetary compensation paid to the agent is now higher because the payoff that the large shareholder obtains from managerial effort is higher. Under delegation instead ($d = 1$) the solutions for w, s and α are the same as in the absence of B. However, the expected loss from implementing project 1 instead of project 0 is now higher and consequently, as shown in the next proposition, the large shareholder is more reluctant to delegate project choice. The next proposition shows that we may never have delegation if B is large relative to b.

Proposition 8. The large shareholder delegates project choice if and only managerial private benefits b *are sufficiently higher than her own private benefits* B *i.e. iff* $b - B > (p_0 - p_1) R$.

Proof: see Appendix.

Delegation is chosen when managerial private benefits are higher than the sum of the large shareholder's private benefits plus the expected loss in returns from choosing project 1 instead of project 0.

8 Discussion

We have analyzed the optimal delegation, ownership, and compensation scheme in a setting where a large shareholder has two tasks: monitoring the manager to assess his ability and supervising the choice of a risky project. The effort of the manager is needed to gather information on projects but preferences over projects are dissonant because of managerial private benefits. An incentive conflict for the large shareholder then arises because a large ownership stake is optimal for the first task (monitoring) while a small stake is called for the second task (supervising project choice without demotivating the manager). The

key insight of the paper is that such conflict can be solved by delegating project choice to the manager but allowing the large shareholder to retain full ownership of the firm. Delegation is optimal when private benefits are relatively large because the prospect of enjoying such benefits becomes a means to motivate the manager. Ownership structure, delegation and monitoring are determined taking into account their interdependence. Monitoring (which is an increasing function of the large shareholder's fraction of shares) positively affects the *ex ante* firing probability because it helps identifying a low-ability manager. However, a higher firing probability reduces managerial incentives provided by private benefits. Then, under delegation, monitoring is optimally reduced by setting severance pay higher than incentive pay. In other words, our model underlines the importance of severance pay from an incentive point of view and offers a rationale for a potentially high severance pay even when the manager is low-ability.

A number of extensions are also analyzed that help clarify our main point. First, if no monetary incentive is available, delegation is always optimal because private benefits are the only means to motivate the manager. Given that severance pay can no longer be used to reduce the large shareholder's incentive for monitoring (and consequently the ex ante firing probability), now the fraction of shares retained by the large shareholder is lowered below one. Secondly, we analyze a different timing in which private benefits are obtained independently of monitoring (i.e. before the possible firing decision). In this case monitoring has no negative effects on incentives, its intensity is higher than in the basic model and this makes delegation optimal in a larger number of cases. Finally, we consider large shareholder's private benefits assuming that these are associated with the most profitable among the risky projects. In this case, delegation implies a higher forgone return for the large shareholder and consequently becomes less likely.

Provided that delegation is optimal in a number of cases, the question arises of how the large shareholder can credibly commit to delegate project choice. In other words the problem is how to make the choice of $d = 1$ (when specified in

the contract), enforceable. We believe that an appropriate dual board structure may be an effective commitment to delegate project choice to the management. Consider a two-tier structure composed by a supervisory board and a management board with the following features. The positions on the two boards are mutually exclusive so that the same person cannot sit on both boards. The management board is mainly composed of managers with executive functions whose objective does not conflict with the objective of the CEO.[11] The large shareholder instead sits on the supervisory board that is mainly composed of members whose objectives are aligned with hers. The supervisory board is in charge of monitoring and of making the firing/retention decision while the management board is in charge of project selection. The choice of such a dual board structure then allows the large shareholder not to interfere with managerial decision without losing control of the firing/retention decision.

This interpretation leads to interesting policy implications for those areas, such as Continental Europe, where concentrated ownership is still the norm. Faccio and Lang (2002), for example, report that family ownership is predominant in 11 European countries: Austria, Belgium, Finland, France, Germany, Italy, Norway, Portugal, Spain, Sweden and Switzerland. In some of these countries, i.e. Germany, Austria, Belgium, the dual structure is mandatory, in other countries like France and Italy, companies can choose between different board models. Our result does not suggest that existing two-tier boards represent the optimal corporate governance solution but it indicates that a specific two-tier structure may be the optimal choice for companies under family control. Although limiting the activism of large shareholders can be a challenging task, it is more difficult for large shareholders to overrule or to interfere with management board decisions when the functions of the two boards are separated and clearly defined by corporate charters. Thus, we believe that a two-tier board structure may be a valuable option in Continental Europe as well as in other areas where

[11] This is usually the case for inside members whose career and salary depend on CEO's decisions. Moreover, executive directors may also share some of the CEO's private benefits. For example, if the CEO expands the firm beyond its optimal size for personal prestige and power motives, all members of the management board benefit from the increased visibility of a larger firm. In other words, the preferences of the executive directors are usually aligned with those of the CEO.

ownership of firms (including that of large corporations) is concentrated and founding families are often 'too active' in firm management.

9 Appendix

9.1 Proof of Proposition 1

Note that the maximization problem (9) can be written as:

$$\underset{\alpha,w,P^F}{Max} \quad e_d A_d + \lambda\overline{\pi} + \alpha_d(1-\lambda)^2\lambda^2\overline{\pi}^2 - \frac{[\alpha_d(1-\lambda)\lambda\overline{\pi}]^2}{2} + e_d Z_d$$

s.t. (7), (8), (3), (1), (2) and where

$$A_d \equiv p_d[R - w\,(1-F_i) - sF_d] \tag{17}$$

and

$$\begin{aligned} Z_d \quad \equiv \quad & \lambda\overline{\pi}(1-\lambda)^2\alpha_d p_d(1-\lambda-P_d^F)(w_d-s_d) - \\ & \frac{(1-\lambda)^2\alpha_d^2 p_d^2(1-\lambda-P_d^F)^2(w_d-s_d)^2}{2} - \lambda\overline{\pi}(1-\lambda)^2\alpha_d^2 p_d(1-\lambda-P_d^F)(w_d-s_d). \end{aligned} \tag{18}$$

We ignore for the moment (1), (2) . Once the solutions for w and s are derived, it will be clear that they are satisfied. The other constraints are substituted in the objective function.

The FOCs for w, s and α are:

$$w: \qquad \frac{\partial e_d}{\partial w}(A_d + Z_d) + e_d[\frac{\partial A_d}{\partial w} + \frac{\partial Z_d}{\partial w}] = 0 \tag{19}$$

$$s: \qquad \frac{\partial e_d}{\partial s}(A_d + Z_d) + e_d[\frac{\partial A_d}{\partial s} + \frac{\partial Z_d}{\partial s}] = 0 \tag{20}$$

$$\alpha: \qquad \frac{\partial e_d}{\partial \alpha}(A_d + Z_d) + e_d[\frac{\partial A_d}{\partial \alpha} + \frac{\partial Z_d}{\partial \alpha}] + \lambda^2\overline{\pi}^2(1-\lambda)^2\,(1-\alpha) = 0 \tag{21}$$

where

$$\frac{\partial e_d}{\partial w} = p_d\,(1-F_d) - (w-s)\frac{\partial F_d}{\partial w} - db\frac{\partial F_1}{\partial w},$$

$$\frac{\partial e_d}{\partial s} = p_d F_d - (w-s)\frac{\partial F_d}{\partial s} - db\frac{\partial F_1}{\partial s},$$

$$\frac{\partial e_d}{\partial \alpha} = -p_d(w-s)\frac{\partial F_d}{\partial \alpha} - db\frac{\partial F_1}{\partial \alpha},$$

and

$$\frac{\partial F_d}{\partial w} = (1-\lambda-P^F)\frac{\partial M_i}{\partial w} = -(1-\lambda-P^F)\frac{\partial M_d}{\partial s} = -\frac{\partial F_d}{\partial s}.$$

$$\frac{\partial F_d}{\partial \alpha} = (1-\lambda-P^F)\frac{\partial M_d}{\partial \alpha}$$

where

$$\frac{\partial M_d}{\partial w} = \alpha(1-\lambda)p_d(1-\lambda-P^F) = -\frac{\partial M_d}{\partial s}.$$

$$\frac{\partial M_d}{\partial \alpha} = \left\{(1-\lambda)\left[\lambda\overline{\pi} + I_{pro}p_d(1-\lambda-P_d^F)(w_d-s_d)\right]\right\}.$$

Summing up (19) and (20) and substituting for the derivatives from the above expressions we obtain:

$$A_d + Z_d = e_d \tag{22}$$

Substituting (22) into (19) and taking the derivatives we have:

$$db(1-\lambda-P^F) = \lambda\overline{\pi}(1-\lambda) - M_d \qquad \text{with } I_{pro} = 1. \tag{23}$$

Considering that P^F must satisfy (3) and that α must not exceed unity, i) for $d = 0$ condition (23) can be satisfied iff $w = s$ and $\alpha = 1$, and ii) for $d = 1$ it cannot be satisfied if $w > s$.

Considering (17) , (18), (7) and substituting $w = s$ in (22) we obtain

$$w_0 = \frac{R}{2}$$

In order to fully characterize the case of $d = 1$, let us first substitute (22) into (21) . Using (3) , after some manipulation we have that, for $w \leq s$, (21) can then be written as:

$$(1-\alpha)\lambda^2\overline{\pi}^2(1-\lambda)^2(1-e_1) = 0.$$

Considering that $e_1 < 1$, this implies $\alpha = 1$. Given $\alpha = 1$, (23) in turn implies:

$$s - w = \frac{b}{p_1(1-\lambda)} \qquad \text{and} \qquad P_1^F = 0$$

Considering (17) , (18), (8) and substituting for $s - w$ in (22) we obtain:

$$w_1 = \frac{R}{2} - \frac{b + (1-\lambda)^2\lambda\overline{\pi})}{2p_1} + \frac{b^2(1-\lambda)(1+3\lambda)}{4p_1}.$$

Finally it can be easily verified that $P_0^F \in [0,1]$.

9.2 Proof of Proposition 3

e_0 and e_1 can be written as:

$$e_0 = p_0 \frac{R}{2}$$

$$e_1 = p_1 \frac{R}{2} + \frac{b}{2}[1 - (1-\lambda)^2(\lambda\overline{\pi} - b)] - \frac{(1-\lambda)^2 b^2}{4}$$

which implies that $e_0 > e_1$ when $b = 0$. Given that

$$\frac{\partial e_1}{\partial b} = \frac{1}{2} + (1-\lambda)^2 \frac{b}{2} > 0,$$

e_1 however is increasing in b ranging from $e_{1|b=0} = p_1 \frac{R}{2}$ when $b = 0$ to a level that tends to $e_{1|b=\beta} = p_1 \frac{R}{2} + \frac{\lambda\overline{\pi}}{2}(1 - \lambda\overline{\pi}\frac{(1-\lambda)^2}{2})$ when $b \to \beta \equiv (1-\lambda)\lambda\overline{\pi}$. When $b \to \beta$ we then have $e_{1|b\to\beta} > e_0$ so that the first part of proposition 3 is implied. Given that the difference between e_1 and e_0 is clearly increasing in $(p_0 - p_1)\frac{R}{2}$ the second part of the proposition immediately follows.

9.3 Proof of Proposition 4

The first part of the proposition immediately follows from $e_{0|w=s=0} = 0$. The values of $\alpha_{1|w=s=0}$ and $P^F_{1|w=s=0}$ are derived from the first-order conditions of the large shareholder's optimization problem that now take the form:

$$\alpha: \qquad -b(1-\lambda-P^F)(1-\lambda)\lambda\overline{\pi}p_1 R + \lambda^2\overline{\pi}^2(1-\lambda)^2(1-\alpha) = 0$$

$$P^F: \qquad p_1 R b(-1 + \alpha(1-\lambda)\lambda\overline{\pi}) < 0$$

implying $P^F_{1|w=s=0} = 0$ and $\alpha_{1|w=s=0} = 1 - \frac{bRp_1}{\lambda\overline{\pi}}$.

9.4 Proof of Proposition 5

The maximization problem of the large shareholder is the same as that analyzed in the proof of Proposition 1, with the only difference that for $d = 1$ managerial effort is given by:

$$\widetilde{e}_1 = p_1 w(1 - F_1) + sF_1 + b$$

implying

$$\frac{\partial \widetilde{e}_1}{\partial w} = p_1 (1 - F_1) - (w - s) \frac{\partial F_1}{\partial w}$$

which in turn implies

$$\frac{\partial \widetilde{e}_1}{\partial w} + \frac{\partial A_1}{\partial w} = 0.$$

Then, if we proceed as in the proof of Proposition 1 and we substitute $A_i + Z_i = e_i$ in (19) we now obtain:

$$\widetilde{e}_1 \frac{\partial Z_1}{\partial w} = 0$$

which implies

$$[\lambda \overline{\pi}(1 - \alpha) - \alpha p_1 (\widetilde{w}_1 - \widetilde{s}_1)(1 - \lambda - P^F)] = 0.$$

Considering that P^F must satisfy (3) and that α must not exceed unity, this expression implies

$$\widetilde{w}_1 - \widetilde{s}_1 = 0 \quad \text{and} \qquad \alpha = 1.$$

Given $\widetilde{w}_1 = \widetilde{s}_1$ any value of $P_1^F \in [0, 1]$ satisfies the FOCs. Using $A + Z = \widetilde{e}_1$, which simplifies to $A = \widetilde{e}_1$ when $w = s$, we obtain:

$$\widetilde{w}_1 = \widetilde{s}_1 = \frac{R}{2} - \frac{b}{2p_1}$$

from (19) .

9.5 Proof of Proposition 6

This proof follows the same line of reasoning used in the proof of Proposition 3. Also in this case the equity value is larger under delegation if and only if managerial effort is larger: i.e., $\widetilde{V}_1 > \widetilde{V}_0$ iff $\widetilde{e}_1 > \widetilde{e}_0 = e_0$. Given that $e_0 = \frac{Rp_0}{2}$ and $\widetilde{e}_1 = \frac{Rp_1}{2} + \frac{b}{2}$ clearly $\widetilde{e}_1 < \widetilde{e}_0$ when $b = 0$. It is immediate to see that $\widetilde{e}_1$ is increasing in b. When $b \to \beta$, $\widetilde{e}_1 > \widetilde{e}_0$ because $\beta > R(p_0 - p_1)$. Given that the difference between $\widetilde{e}_1$ and $\widetilde{e}_0$ is clearly increasing in $(p_0 - p_1)\frac{R}{2}$, the second part of the proposition immediately follows. $\widetilde{b} < \overline{b}$ follows from $\widetilde{e}_1 > e_1$ when $b > 0$.

9.6 Proof of Proposition 7

The results for $d = 1$ are those derived in Proposition 5. When $d = 0$ we can replicate the same procedure used in the proof of Proposition 1 considering that now in the expression for A we also have the constant B:

$$\widehat{A} \equiv \{p_0[R - w_0(1 - F_0) - s_0F_0] + B\}.$$

As a consequence, after having verified that $w = s$, we set $\widehat{A} = \widehat{e}_0$ and we obtain:

$$\widehat{w}_0 = \widehat{s}_0 = \frac{R}{2} + \frac{B}{2p_0}.$$

9.7 Proof of Proposition 8

This proof follows the same line of reasoning used in the Proof of Proposition 3 and 6. Again, the equity value is larger under delegation if and only if managerial effort is larger: i.e. $\widehat{V}_1 > \widehat{V}_0$ iff $\widehat{e}_1 > \widehat{e}_0$. Given the values of $\widehat{e}_1$ and $\widehat{e}_0$, this implies

$$\frac{Rp_1}{2} + \frac{b}{2} - \frac{Rp_0}{2} - \frac{B}{2} > 0$$

or

$$b - B > (p_0 - p_1)R.$$

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