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Separation of Ownership and Control: Delegation as a Commitment Device

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Abstract

This paper provides a theoretical model for explaining the separation of ownership and control in firms. An entrepreneur hires a worker for providing effort to complete a project. The worker's effort determines the probability that the project is completed on time, but the worker receives private benefits for every period she is employed. We show that hiring a manager on a short-term contract may increase firm value and we identify the conditions under which separation of ownership and control is optimal.

Keywords: commitment problem, control rights, control structure, moral hazard, private benefit, separation of ownership and control, soft-budget constraint, strategic delegation

JEL Classification: D86, G34, J31, L22, L26

1 Introduction

The issue of separation of ownership from control has been a central question in economics and finance. The first contributions go back to Berle and Means (1932) and even Adam Smith (1776). The stylized fact of this literature is the large corporation, which is owned by many small stockholders but is run centrally by professional managers, who have a negligible fraction of total ownership. The associated agency costs and the corporate mechanisms to combat them have been the central focus of the early literature on this topic.[1]

Despite being challenged by recent empirical analyses,[2] this stylized fact still reflects the situation for a substantial fraction of large corporations.[3] There are mainly two arguments provided for explaining the separation of ownership and control: (i) Shareholders do not have the ability, expertise or the knowledge to run firms, while managers do. (ii) The opportunity cost of time for large shareholders is high, namely they prefer leisure or starting a new company than dealing with management issues. Though perfectly valid, these arguments do not relate the firms' observable characteristics to their control structure, implying that the former are unrelated to the latter. However, this is not the case (see for example Demsetz and Lehn (1985)).

This paper proposes an alternative theoretical explanation on why investors may prefer to separate ownership from control and relates firm characteristics to the optimal choice of control structure. The main argument is that managers are "tougher" on workers than firm owners because they do not have a large stake on its long-term prospects. If a manager's payoff depends on the short-term returns of the firm, then

[1]See Monsen and Downs (1965), Alchian and Demsetz (1972), Jensen and Meckling (1976), Fama (1980), Fama and Jensen (1983), and Demsetz (1983), Demsetz and Lehn (1985).

[2]See Porta, Lopez-De-Silanes, and Shleifer (1999), Holderness (2009)

[3]For example, Mikkelson and Partch (1989) finds that the top three officials own less than 10 percent of the stock combined for 60 percent of the companies. Holderness, Kroszner, and Sheehan (1999) find that the average stock-holdings of a CEO is 1.25 percent (the median is only 0.06). Jensen and Murphy (1990) report similar findings.

she is more likely to terminate currently unprofitable projects, even if they have positive long-term NPV. Though this generates ex-post inefficient decisions, it forces employees to work harder in order to avoid project terminations because being employed in the firm confers private benefits to them. Our setup is thus consistent with empirical papers in management, which show that entrepreneurs care more about the long-term prospects of their firms and tend to foster long-term relationships with customers and employees (see for example Pruitt (1999), Miller and Le Breton-Miller (2005), James (2006), Arregle, Hitt, Sirmon, and Very (2007), Gomez-Mejia, Haynes, Nunez-Nickel, Jacobson, and Moyano-Fuentes (2007), Miller, Breton-Miller, and Scholnick (2008) for studies on family-owned firms).

In order to make this argument as clear as possible, a simple two-period model with one entrepreneur and one worker is presented in section two of the paper. The entrepreneur is assumed to have full ownership and control over the firm and she is not financially constrained.[4] She also owns a project, which may take one or two time periods to complete, and which increases the firm's profits once it is completed. The worker exerts non-verifiable effort, which increases the probability that the project is completed at the end of period one, but she receives a private benefit for every period she is employed by the firm before the project's completion. As a result, the entrepreneur needs to compensate the worker for the loss of the private benefit, if she wants the project to complete sooner.

It is shown that, if the entrepreneur could commit to liquidate the project, then the worker would exert high effort at a lower wage. However, this threat is not credible, because the continuation value of the project is higher than the liquidation value. In

[4]In fact, it is irrelevant for our purposes if the firm has only one or many owners. The case of a single owner is considered because it is the simplest possible and because it allows one to distinguish the importance of the control structure (owners versus managers) from that of the ownership structure (large versus small shareholders). For the latter case, see the papers by Grossman and Hart (1980), Shleifer and Vishny (1986), Grossman and Hart (1988), Harris and Raviv (1988), Bebchuk (1994), Burkart, Gromb, and Panunzi (1997) and Burkart, Gromb, and Panunzi (1998).

fact, depending on the worker's risk aversion, the entrepreneur may prefer to provide no incentives for high effort. This problem can be solved by hiring a manager and giving her a payment conditional only on short-term (period-one) profits. This induces the manager to liquidate the project if it is delayed. The entrepreneur's commitment problem is solved and the worker exerts high effort. Thus, delegation of control strictly increases the owner's payoff.

The model is extended in section three with the addition of a moral hazard problem from the manager's side: the manager is allowed to appropriate a fraction of realized profits and transform them into managerial benefits. This allows one to study the more plausible case, where giving up control to the manager may generate undesirable consequences (i.e. agency costs). We provide the optimal managerial contract and we examine the conditions under which separation of ownership and control is optimal.

The main contribution of the paper is to provide a different explanation of why separation of ownership and control may be optimal for firm owners. In this way it complements the existing literature of separation of ownership and control by presenting an argument which has not been analyzed so far. Moreover, it predicts that separation of ownership and control is negatively correlated with profit variability, which is consistent with empirical findings (Demsetz and Lehn, 1985; Claessens, Djankov, and Lang, 2000).

There are several other strands of literature that are related to it. First, models of separation of ownership and control are provided by other papers. The early literature (Jensen and Meckling, 1976; Fama, 1980; Fama and Jensen, 1983; Demsetz, 1983) recognized the existence of agency costs in the firm and examined how the ownership and control structure is used in order to combat them. But they did not explain why the decision power had to be delegated to managers in the first place.[5]

[5] For a more complete treatment of the early literature on the separation of ownership and control and the recent debate regarding its empirical relevance, see the papers by Berle and Means (1932), Monsen and Downs (1965), Alchian and Demsetz (1972), Demsetz and Lehn (1985), Mikkelson and Partch (1989), Jensen and Murphy (1990), Porta, Lopez-De-Silanes, and Shleifer (1999), Holderness,

More recently, Acemoglu (1998) explains the separation of ownership and control as a signal of the entrepreneur to financial markets about the quality of her project. On the other hand, this paper does not relate the presence of managers to financial markets but to the internal workings of the firm. The managers' roles are also different: they are not used as signaling devices but as commitment devices.

Ferreira, Ornelas, and Turner (2010), based on Ornelas and Turner (2007), examine the separation of ownership and control in a model of optimal dissolution of partnership. Two partners allocate ex-ante and ex-post ownership rights in order to optimize ex-post incentives in revealing their type and allocating optimal control rights. Thus, their model is one of shareholders reaching an agreement on who should run the firm, while this paper adopts the principal-agent framework. Moreover, the main friction in their model is one of hidden types, while in this paper it is one of hidden actions.

Furthermore, the paper is closely related to the literature on the optimal allocation of decision and ownership rights and the detrmination of firm boundaries (Coase, 1937; Williamson, 1971; Grossman and Hart, 1986). The main focus of this literature is how asset ownership should be allocated given that the ownership structure affects the internal organisation of the firm and the allocation of decision rights (Matouschek, 2004; Alonso, Dessein, and Matouschek, 2008; Dessein, Garicano, and Gertner, 2010).[6] In these models the delegation of certain decisions to firm workers is taken as given (for example, in Dessein (2014) workers are always responsible for reducing the cost of inputs), and the analysis is based on the optimal ownership structure.

On the other hand, in this paper the ownership structure is taken as given and we ask the question on when the firm owners would optimally prefer to delegate their decision rights to the firm managers. In this respect our paper is part of the wider

Kroszner, and Sheehan (1999), Holderness (2009).

[6]For a more complete presentation of this literature and its relation to incomplete contracting see the survey papers by Aghion, Bloom, and Van Reenen (2014) and Legros and Newman (2014).

literature on delegation, two strands of which are particularly relevant.

First, following Schelling (1980), the theory of strategic delegation (Katz, 1991; Bensaid and Gary-Bobo, 1993; Caillaud, Jullien, and Picard, 1995; Bester and Sakovics, 2001; Fershtman and Gneezy, 2001; Bond and Gresik, 2011; Gerratana and Koçkesen, 2012) examines how delegation can act as a commitment device to increase a party's effective bargaining power. This has been used to explain the separation of ownership and control in firms (Sklivas, 1987; Zhang and Zhang, 1997; Kopel and Riegler, 2006, 2008). The main idea of these papers is that firm owners delegate their decision power to managers as a form of strategic precommitment against competing firms. For example, Sklivas (1987) examines how delegation can be used in a Bertrand oligopoly setting to promote collusive behavior, while Kopel and Riegler (2008) examine the effects of strategic delegation when firms compete in terms of R&D expenditures.[7] Compared to these papers, this papers differs in that instead of focusing on the bargaining power of the firm over its competitors, it makes the argument that delegation can be used to solve commitment problems within the firm and improve the shareholder's bargaining power over the workers.

Second, there is a growing literature on the optimal delegation of decision power in the presence of incomplete information between the principal and her agent. Some influential papers in this literature are Holmstrom (1984), Aghion and Tirole (1997), Faure-Grimaud, Laffont, and Martimort (2003) and Alonso and Matouschek (2008). A common assumption of the papers above is that the principal needs the agent's private information in order to make a decision, but does not have the opportunity to obtain it herself. In contrast, in this paper, even though the entrepreneur can substitute for the manager's role entirely, she needs her in order to commit on liquidating a delayed project.

[7] See also Jansen, van Lier, and van Witteloostuijn (2007) and Englmaier and Reisinger (2014) for papers where strategic delegation leads to more competitive outcomes.

The introduction of the manager in section three makes this paper relevant to papers which deal with both moral hazard and the disclosure of private information (Darrough and Stoughton, 1986; Picard, 1987; Doepke and Townsend, 2006). With respect to the first strand of the literature, the paper by Johnson (2013) is considering a similar problem. Firms bid for a project and then exert unobservable effort (in continuous time), which determines the probability of the project's success. However in that setting there is no commitment problem from the principal's side and the main focus of the analysis is on the design of the optimal contract. On the other hand, this papers examines a simpler two-period version of the problem with a commitment problem and no initial private information on the agents' side.

The paper can also be categorized in the soft-budget-constraint literature (Dewatripont and Maskin, 1995; Dewatripont and Roland, 2000; Kornai, Maskin, and Roland, 2003). The entrepreneur of this paper faces a soft-budget constraint: if the project is delayed she does not want to liquidate it, even though this is optimal ex-ante. Dewatripont and Maskin (1995) and Schmidt (1996) propose decentralization as a potential solution to soft-budget-constraint problems, while here the proposed solution is delegation.

Commitment problems have been examined in many other contexts, most notably in public policy (Kydland and Prescott, 1977; Barro and Gordon, 1983). Similarly to this paper, Rogoff (1985) considers delegation to an agent with a different objective function than the principal as a solution to these problems. The main difference between his paper and this is that in Rogoff (1985) this difference is exogenous: the agent has intrinsically different preferences from the principal. In this paper the difference in objectives arises endogenously: it is through the managerial contract, which provides, by construction, myopic incentives to the manager, that the principal aligns her ex-post objectives to the ex-ante.

Finally, the paper is related to the literature on deadlines. The papers by Toxvaerd (2006), Toxvaerd (2007), Mason and Valimaki (2008), Bonatti and Horner (2011) examine how deadlines are used in order to mitigate dynamic moral hazard problems. The main difference is that, in these papers, deadlines are used to mitigate free-riding problems within a team, while we deal with a commitment problem. On the other hand, O'Donoghue and Rabin (1999) examine how deadlines can be used to provide incentives to agents with time-inconsistent preferences, while the commitment problem in this paper involves fully rational agents.

2 A Simple Model

2.1 The Project

There are two time periods, a start date 0 ($t = \{0, 1, 2\}$) and two agents, the entrepreneur, E, and the worker, W. E is risk neutral. W's utility is additively separable: $U_W = u(w) + b - c(e)$, where $u(x)$ is a concave function: $u' > 0$, $u'' < 0$, $u(0) = 0$, w is W's wage in monetary terms, b is the private benefit she enjoys for every period she is employed in the firm, and $c(e)$ is the cost of effort. Effort is unobservable and there are two effort levels: high ($\overline{e}$) and low ($\underline{e}$), with corresponding effort costs $c(\overline{e}) = \overline{c}$ and $c(\underline{e}) = 0$.

E owns a firm which generates profits ρ_t at the end of periods one and two. ρ_t is a random variable, normally and independently distributed in each period, with mean τ and variance σ^2: $\rho_t \sim N(\tau, \sigma^2)$. E can increase the firm's average profits (τ) by hiring W at $t = 0$ in order to complete a project. W's participation in the project is necessary for two reasons: (i) W exerts effort at $t = 0$ which determines the probability that the project will be completed on time, (ii) W is employed by E in order to maintain the project until it is completed or it is terminated. Without W's maintenance the project cannot yield any returns to the firm even if it is to be completed on time, so that W's employment in the firm until the project's completion is necessary. However, once the project is completed, W's services are not necessary anymore and she leaves the firm.[8]

The probability of the project completing on time, $p(e)$, depends on W's effort e. If W exerts high effort then the project is completed on-time (*state o*) at $t = 1$ with probability $p(\overline{e}) = \overline{p}$ and it is delayed (completed at $t = 2$: *state d*) with the remainder probability. Similarly, if W exerts low effort the project is completed on time with probability $p(\underline{e}) = \underline{p}$ and is delayed with probability $1 - \underline{p}$. If it is completed on time, then the project generates additional profits V_o for the firm in periods one and two. In other words, for every realization of ρ_t, firms' profits are $\rho_t + V_o$, implying that expected profits increase to $\tau + V_o$ in each period. The delayed project does not yield any additional profits in period one ($V_{d1} = 0$) and yields additional profits only in period two: $V_{d2} = V_d$. It is assumed that $\overline{p} > \underline{p}$, $\overline{c} > 0$ and that exerting high effort is efficient: $\Delta p(2V_o - V_d) > \overline{c}$, where $\Delta p = \overline{p} - \underline{p}$. Finally, W's reservation utility is normalised to zero.

At some point in time $\tilde{t}$ before the end of the first period ($0 < \tilde{t} < 1$) E finds out whether the project will be delayed or not. Then, she can choose either to liquidate the project ($L = 1$) and forgo V_d or to let the project continue ($L = 0$). If E liquidates the project, then W leaves the firm without being paid any wages.[9] Moreover, profits increase by V_l at $t = 1$ and remain unchanged at $t = 2$ ($V_{l1} = V_l$, $V_{l2} = 0$). This implies

[8]The justification of this assumption is that E maintains the right to fire W by paying a compensation cost for terminating the employment contract. As long as the compensation cost is not higher than the expected value of future wages, E would fire the W only when her presence in the firm is not necessary. We return back to this point below.

[9]The analysis that follows is isomorphic to the analysis of a model in which E retains the right to terminate W's contract at $\tilde{t}$ by paying a fixed compensation cost k but not the wage. This option expires at $\tilde{t}$, so that if E keeps W in the firm until $t = 1$ then her wage is due (i.e. if E decides to fire W after $\tilde{t}$, then she needs to pay the promised wage). In this case one can show (the result is available by the author upon request) that E would exercise the option to fire W at $\tilde{t}$ only if she liquidates the project and if k is less than the expected value of future wages. In order to keep the model as simple as possible, we have implicitly set $k = 0$ and we have avoided specifying the option to fire W formally, but the qualitative results remain unaffected.

that the expected profits of the firm after liquidation are $\tau + V_l$ and τ for periods one and two respectively. We assume that $V_o > V_d > V_l > 0$. The liquidation value of the project can be interpreted as either the value that other firms are willing to pay in order to undertake the project or the scrap value for the assets invested in it. In either case, what is important is that the project generates positive synergies in E's firm, so that letting the project complete with delay generates more profits than liquidating it.

Whether the project is delayed or not is *private information* to the relevant decision maker at time $t = 1$ (E in this case) and *is non-verifiable.* The project's current status and its completion date are also *non-verifiable.* Moreover, E can not impose financial penalties to W (W is employed under *limited-liability*). These assumptions imply that E can not provide an incentive contract which is conditional on the project's completion date or status, and, therefore, the wage contract $\boldsymbol{w}$ can be made contingent only on the time-periods that W is employed and on the realized profits of the firm π_t : $\boldsymbol{w} = \{w(\pi_1, 1), w(\pi_2, 2)\} \geq 0$. And because W is risk-averse with respect to the wage, providing incentives through the wage may be very costly. Figure 1 below presents the timing of events so far.

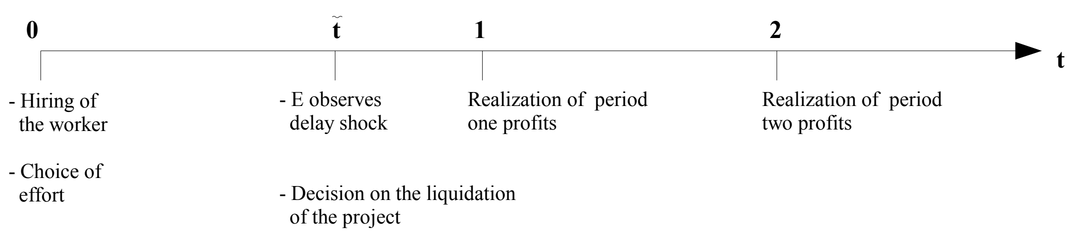


Figure 1: Timing of events

Before we examine how the liquidation decision may have a positive effect on W's incentives, a brief comment on the interpretation of the term b is noteworthy. As stated above, b is the private benefit that W receives for every period she is employed in E's firm. Therefore, it can be interpreted as any perk or benefit of her employment, which is non-contractible and which is not offered by W's *next-best employment opportunity*.

There can be several sources of such non-contractible perks, like the firm's location (proximity to worker's residence or to city center), good working conditions, friendly working atmosphere or good relations with colleagues, esteem from working in a reputable firm, work which involves skills that provide intrinsic satisfaction to the worker, etc. For example, blue-collar workers' remuneration is usually non-negotiable and does not vary with the above conditions. Therefore, if E's firm is located close to W's residence, W receives a perk of employment that she may not expect to find from her next-best employment opportunity if she loses her current job. The term b in our model is used to capture all the above potential forms of private benefits.

In terms of modelling, we assume that b is common knowledge between W and E but that it is a non-contractible parameter. Moreover, it does not affect the firm's profit levels directly (i.e. it does not have an impact on productivity), it is not available by W's next-best employment opportunity and it accrues over time.[10] These assumptions imply that b may affect the optimal wage contract indirectly (i.e. as a parameter) through the incentive compatibility and the participation constraint.

2.2 The Value of Liquidation

Let us examine the value of the liquidation decision in this set-up. As noted earlier, since W's effort level, the project's status and E's liquidation decision are unobservable and non-verifiable, the wage contract can be made contingent only on the realized level

[10]Note that the use of the term private benefit in our model differs from its usual definition in the literature. For example, in Holmstrom and Tirole (1997) or in Pagano and Volpin (2006), the private benefit is part of the unobservable output which is appropriated by the agent and the principal can prevent it by designing the contract appropriately. So, in the literature it is treated as a moral hazard problem, while in this paper the entrepreneur cannot prevent its consumption.

of profit and on the time periods: $\boldsymbol{w} = \{w(\pi_1, 1), w(\pi_2, 2)\}$. In terms of notation, π_t are the realized profits, L_s is the liquidation decision in state s ($s = \{o, d\}$), V_{st} is the non-liquidated project's value in state s and period t, and V_{lt} is the liquidated project's value in period t. Then $\pi_t = \rho_t + (1 - L_s)V_{st} + L_s V_{lt}$.[11]

Hence, π_t is a random variable, normally distributed with mean $\mu_{st} = \tau + (1 - L_s)V_{st} + L_s V_{lt}$. Let $f(\pi_t|\mu_{st})$ denote the density function of π_t conditional on its mean μ_{st}. Then, if the project is completed on time, $\mu_o = \tau + V_o$ in both periods, if the project is delayed $\mu_{d1} = \tau$, $\mu_{d2} = \tau + V_d$, and if the project is liquidated $\mu_{l1} = \tau + V_l$, $\mu_{l2} = \tau$. Therefore, W's expected utility is equal to:

$$E_\pi(U_w) = b + p(e)(1 - L_o) \int_{-\infty}^{+\infty} u[w(\pi_1, 1)] f(\pi_1|\mu_o) d\pi_1$$

$$+ [1 - p(e)](1 - L_d) \left[b + \int_{-\infty}^{+\infty} u[w(\pi_1, 1)] f(\pi_1|\mu_{d1}) d\pi_1 + \int_{-\infty}^{+\infty} u[w(\pi_2, 2)] f(\pi_2|\mu_{d2}) d\pi_2 \right] - c(e) \qquad (1)$$

The first term on the right-hand-side is the private benefit that W receives for being employed in the firm for a period. She receives this benefit regardless of the project's progression status or its liquidation. The second term is the expected value of period one wage conditional on the project not being liquidated, while the third term is W's expected utility from the project being delayed and not liquidated. Since delay and no liquidation imply that W stays with the firm until $t = 2$, then she receives the wages of periods one and two plus the private benefit of the second period. Note that if the project is liquidated then W leaves the firm at $\tilde{t}$ and she does not receive any wage (see also footnotes 8 and 9), so she receives only b in this case.

E has three option to consider: (i) She may try to induce high effort though the

[11] Also recall that $V_{o1} = V_{o2} = V_o$, $V_{d1} = 0$, $V_{d2} = V_d$, $V_{l1} = V_l$, $V_{l2} = 0$.

design of the wage contract and avoid liquidation. (ii) She may liquidate the project if it is delayed to exert pressure to the worker to work harder. (iii) She may choose to provide no incentives to the worker.

If E does not liquidate the project in the case of delay ($L_o = L_d = 0$), then, for inducing high effort, she needs to provide the wage schedule $\hat{\mathbf{w}}$ (see the appendix for the derivation):

$$\hat{w}(\pi_1, 1) = \begin{cases} (u')^{-1} \left[\frac{\overline{p} f(\pi_1|\mu_o) + (1-\overline{p}) f(\pi_1|\mu_{d1})}{\hat{\lambda}[f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1})]}\right] & \text{if } f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1}) > 0 \\ 0 & \text{if } f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1}) \leq 0 \end{cases} \tag{2}$$

$$\hat{w}(\pi_2, 2) = 0$$

Note that the above optimal wage schedule depends on b indirectly, through the Langrangian multiplier λ and the incentive compatibility condition.[12] The fact that $b > 0$ also implies that W receives strictly positive utility from her employment and, due to limited liability, it is impossible for E to extract this benefit through the wage and to make the participation constraint binding. So, overall, b affects the optimal wage schedule through the incentive constraint but not through the participation constraint. As a result, the expected payoff for the entrepreneur in the case of no-liquidation and high effort exertion, is equal to:

$$\sum_{t=1}^{2} E(\pi_t) \;=\; 2\tau + 2\overline{p} V_o + (1-\overline{p}) V_d - E_\pi[\hat{w}(\pi_1, 1)] \tag{3}$$

E's payoff in this case consists of the average profits of period one and two plus the expected value of the project, given high effort exertion, minus the expected value of

[12] See equation (12) in the appendix.

the wages. On the other hand, if E liquidates after she finds out that the project is delayed, then she can induce high effort by paying (see the appendix for the derivation):

$$\overline{w}_1 = u^{-1}\left(\frac{\overline{c}}{\overline{p} - \underline{p}}\right)$$

Note that $\overline{w}_1$ is a fixed payment, independent of profits, in this case. It is also independent of b, because, if the project is liquidated after delay, W can not receive the utility from b from more than one period regardless of her effort choice.[13] So, in this case b does not affect the optimal wage schedule either through the incentive compatibility constraint or through the participation constraint.

On the other hand, in terms of wages, it is less costly for E to induce high effort when the project is liquidated after delay than when it is not: $\overline{w}_1 < E_\pi[\hat{w}(\pi_1, 1)]$ (see the appendix for the formal proof). Hence, E's expected payoff is equal to the average profits of period one and two plus the expected value of the project, given high effort exertion and liquidation, minus the constant wage $\overline{w}_1$:

$$\sum_{t=1}^{2} E(\pi_t) \;=\; 2\tau + 2\overline{p}V_o + (1-\overline{p})V_l - \overline{p}\overline{w}_1 \tag{4}$$

Finally, E may choose to provide no incentives to the worker. Clearly, in this case it is optimal to give the minimum possible wage and to not liquidate the project, and E's expected payoff is equal to:

$$\sum_{t=1}^{2} E(\pi_t) \;=\; 2\tau + 2\underline{p}V_o + (1-\underline{p})V_d \tag{5}$$

The optimal decision for E depends on the comparisons between (3), (4) and (5). In this paper we are particularly interested in the case where E prefers to liquidate the delayed project in order to lower the wage for W, but this is not a credible option. This

[13] See equation (14) in the appendix.

is the case when the following conditions are satisfied.

$$(3) \geq (2) \;\Leftrightarrow\; E_\pi[\hat{w}(\pi_1, 1)] \geq (1 - \overline{p})(V_d - V_l) + \overline{pw}_1 \tag{6}$$

$$(3) \geq (4) \;\Leftrightarrow\; (\overline{p} - \underline{p})(2V_o - V_d) \geq (1 - \overline{p})(V_d - V_l) + \overline{pw}_1 \tag{7}$$

$$V_d > V_l + \overline{w}_1 \tag{8}$$

Conditions (6) and (7) state that E's ex-ante optimal action is to liquidate the project if it is delayed. Condition (8) is required to generate the commitment problem. At $\tilde{t}$ E finds out whether she should liquidate the project or not. However, if E liquidates she earns the liquidation value V_l and forgoes the value of the delayed project. She also avoids paying $\overline{w}_1$. As a result, if $V_d > V_l + \overline{w}_1$, E's optimal choice at $\tilde{t}$ is to avoid liquidation, while at $t = 0$ E would like to commit to liquidate the delayed project.

In other words, if conditions (6), (7) and (8) hold, the threat of liquidation is optimal but not credible. Since W anticipates that, exerting high effort through the threat of liquidation is impossible and E can induce high effort only through the wage contract in (2). Effectively, E suffers from a *soft-budget constraint.*

We are interested in this case because E can solve the commitment problem and achieve the most profitable option for her through delegation. To see this, suppose that E hires a manager (M) to run the firm instead of her under a contract which provides a payment conditional on short-term (period-one) profits. Also, suppose that E can not impose financial penalties to M and consider the following simple contract. M is hired to control the firm for period one only, i.e. M is given the authority to determine L_s at time $\tilde{t}$, and her reward y_1 is a linear function of the period one profits: $y_1 = \epsilon E(\pi_1)$, where $E(\pi_1)$ are the expected profit of period one and ϵ is a small, positive constant.

W is hired under the contract $\overline{w}_1$.

Under y_1, M prefers to let the project continue if there is no delay, since $V_o - \overline{w}_1 > V_l$ by (8) and $V_o > V_d$. But if the project is delayed, M prefers to liquidate it. This is because $V_l > -\overline{w}_1$ so that, even though the long term value of liquidation is less than that of continuation ($V_l < V_d - \overline{w}_1$), its short term value is positive. By liquidating the delayed project, M both increases short-run (i.e. period one) profits by V_l and avoids paying out $\overline{w}_1$, so her payoff strictly increases. Hence, delegation solves the entrepreneur's commitment problem and increases firm value.

The main intuition is that the manager does not suffer from the commitment problem that the entrepreneur faces, because her payoff is constructed through the contract and does not depend on the primitives of the economy. As a result, the delegation of control to the manager can relax the incentive compatibility of the worker and this increases the entrepreneur's payoff. In other words, the separation of ownership and control is optimal from the entrepreneur's point of view in this case.[14]

When are conditions (6)-(8) more likely to hold? (6) is more likely to hold as W becomes more risk averse because $E_\pi[\hat{w}(\pi_1, 1)]$ is an increasing function of risk aversion. As W becomes extremely risk averse, $E_\pi[\hat{w}(\pi_1, 1)]$ approaches infinity, so for any level of the other parameters there is a level of risk aversion above which (6) holds. Also, ceteris paribus, (7) is more likely to hold as V_o increases, while (8) is more likely to hold as Δp increases, because an increase in Δp reduces $\overline{w}_1$.

Overall, delegation of control is more likely to be preferable to entrepreneurial control when the worker is substantially risk averse, completing the project on time improves profitability significantly and the worker's effort is an important factor in in-

[14] It is worth pointing out that this solution is not renegotiation-proof. After the manager discovers that the project's completion is delayed she has an incentive to renegotiate her contract with the entrepreneur and receive a higher expected payment for not liquidating the project. An earlier version of the paper showed how renegotiation is blocked when an adverse selection problem is introduced in the model, but to simplify the analysis it is omitted here. For a related point see Edlin and Hermalin (2000).

creasing the probability of on-time completion. Nonetheless, managerial control also entails agency costs for the entrepreneur and we analyze this case in the next section.

3 A Model with Managerial Moral Hazard

3.1 The Manager

This section extends the model of the previous section to allow the entrepreneur to solve her commitment problem through delegating the control of the firm to a manager. However, delegation of control generates new costs for the entrepreneur. We allow the manager to appropriate part of the firm's profits which leads to a managerial moral hazard problem. Thus the rents earned by the manager reduce the value of delegation for the entrepreneur and generate a trade-off between worker incentives and control incentives.

As before, there are two time periods and a start date 0: $t = \{0, 1, 2\}$. There are three agents: the entrepreneur (E), the worker (W) and the manager (M). E and M are risk neutral, but W is risk-averse with respect to the wage (we assume the same additively separable utility as in section 2). The discount factor is one for all agents and the firm is owned in its entirety at $t = 0$ by E. Both W and M are protected by limited liability (non-negative rewards).

We assume that inequalities (6)-(8) from the previous section hold and that E may choose to hire M at $t = 0$, just before signing the wage contract with W. In this case E and M sign the managerial contract y which defines M's remuneration as a function of the firm's profits. If E delegates control to M then M is responsible for deciding whether to liquidate the project at $\tilde{t}$. As in section 2, ρ_t is the random stream of profits in periods one and two ($\rho_t \sim N(\tau, \sigma^2)$) and W's effort ($e$) determines the probability that the project is completed on-time. All the variables with respect to the project

$(e, p(e), c(e), V_{st}, V_{lt}, L_s)$ and their interaction remain as in section 2.

In addition, it is assumed that the manager can appropriate part of the profits, before any wages are paid, and transform them into private benefits or non-pecuniary rewards at an exogenously given and constant return factor q. That is, for every single unit of profit that the manager appropriates, proportion q is transformed into utility for the manager and proportion $1-q$ is lost as appropriation cost. Let us consider the interesting case where $0 < q < 1$, so that the delegation of control to the manager is neither too costly to the entrepreneur (when $q = 1$ the manager appropriates all profit) nor costless (when $q = 0$ the manager appropriates no profit).

The reason why this friction is introduced in the model is because it provides a simple and tractable way to generate divergence of objectives between the manager and the entrepreneur and because it leads to profit-sharing between the two. It is also an intuitively appealing explanation of how managers may destroy value in firms and this is the reason why it has been used in the corporate governance literature (see for example Burkart, Gromb, and Panunzi, 1998).

Formally, after observing the "internal" profits $\tilde{\pi}_t = \rho_t + (1 - L_s)V_{st} + L_s V_{lt}$ (profits before appropriation), M decides to appropriate a part of them ($r_t(\tilde{\pi}_t)$). A fraction q of appropriated profits becomes managerial utility, while the remaining $(1 - q)r_t(\tilde{\pi}_t)$ becomes deadweight-loss for the firm. Because the projects status, the internal profits and profit appropriation are observable only by the decision maker in the firm (M in the case of delegation), only the profits after appropriation are verifiable: $\hat{\pi}_t = \tilde{\pi}_t - r_t(\tilde{\pi}_t)$. This implies that the wage contract is contingent on profits after appropriation and on time periods: $w(\hat{\pi}_t, t)$, while the managerial contract and entrepreneurial returns are contingent on profits after wages: $\pi_t = \hat{\pi}_t - w(\hat{\pi}_t, t)$ (profits after wages), $y_t(\pi_t)$ (managerial contract/reward in period t), $u_e = \pi_t - y_t(\pi_t)$ (entrepreneurial returns). These three types of profits (profits before appropriation, profits after appropriation and profits after wages) need to be formally distinguished because the appropriation decision is not observable and the worker's claim on profits (the wage) is senior to either the manager's or the entrepreneur's claim. Overall, the following list of profits clarifies the different definitions and assumptions.

- **profits before appropriation:** $\tilde{\pi}_t = \rho_t + (1 - L_s)V_{st} + L_s V_{lt}$ (unobservable/non-verifiable)

- **profits after appropriation:** $\hat{\pi}_t = \rho_t + (1 - L_s)V_{st} + L_s V_{lt} - r_t(\tilde{\pi}_t)$ (verifiable)

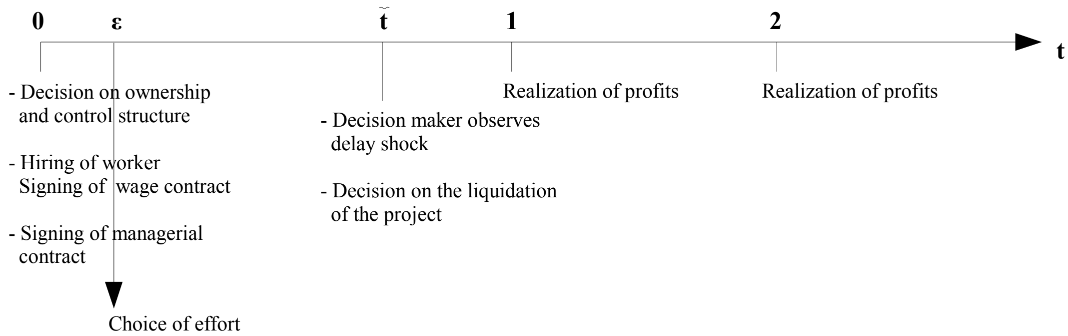
- **profits after wages:** $\pi_t = \rho_t + (1 - L_s)V_{st} + L_s V_{lt} - r_t(\tilde{\pi}_t) - w(\hat{\pi}_t, t)$ (verifiable)

It is also assumed that E can choose the managerial contract's duration δ. That is, E may hire M for only the first period ($\delta = 1$), after which M is fired (i.e. she receives no future payments by E) and E resumes control of the company. We call this the **short-term** contract. Or E may hire M for both periods ($\delta = 2$), which we call the **long-term** contract. Overall, the managerial reward is determined by profits after wages and duration: $\{y_t(\pi_t|\delta)\}$.

The timing of events is as follows. At $t = 0$ E hires W under the contract $\mathbf{w}(\hat{\pi}_t, t)$ and decides whether to delegate control to M or not and for how long by offering the contract $\{\mathbf{y}_t(\pi_t|\delta)\}$ to M. At $t = \tilde{t}$, the firm's decision maker (either E or M, depending on the delegation decision) decides whether to liquidate the project after having observed whether the project is delayed. The firm's profits and agents' payoffs are then realized at periods $t = \{1, 2\}$. The figure below shows this timing.

3.2 Optimal Managerial Contract

In order to analyse the optimal control structure we first consider the case where E delegates control to M and we determine the optimal managerial contract. Given that



the conditions (6)-(8) of section 2.2 hold, delegation is valuable for E when M liquidates the delayed project so as to induce W to exert hight effort under the wage schedule $\overline{w}_1$. Therefore, the managerial contract needs to induce M to liquidate the project if it is delayed and to not liquidate it otherwise.

Furthermore, the managerial contract needs to minimize M's rents from the possible appropriation of profits. Therefore, to solve for the optimal managerial contract $\{y_t(\pi_t|\delta)\}$ we require that the following incentive compatibility conditions hold:

$\boldsymbol{IC_1}$ **:** In the end of each period M should be indifferent between appropriating part of the profits or not. If this condition is satisfied then the profits before appropriation, $\tilde{\pi}_t$, are equal to the profits after appropriation, $\hat{\pi}_t$.

$\boldsymbol{IC_2}$ **:** Given the wage schedule $\overline{w}_1$, M liquidates the project, if it is delayed.

$\boldsymbol{IC_3}$ **:** She does not liquidate it otherwise.

Formally, let $p_s(e)$ be the probability of state $s = \{o, d\}$ arising conditional on W exerting effort $e = \{\overline{e}, \underline{e}\}$ and let I_δ be an indicator function which takes the value 1 if the contract is long-term ($\delta = 2$) and takes the value 0 if the contract is short-term ($\delta = 1$). Then the optimal contract is the solution to the following problem:

$$\max_{y_1(\pi_1|\delta),y_2(\pi_2|\delta),\delta} \left\{ \sum_{s\in\{o,d\}} p_s(e) \left[\sum_{t=1}^{2} \int_{-\infty}^{+\infty} \left[\pi_t - y_t(\pi_t|\delta)\right] f(\pi_t|\mu_{st}) d\pi_t \right] \right\} \tag{9}$$

subject to:

$$arg \max_{r_t} \{y_t(\tilde{\pi}_t - r_t - w(\hat{\pi}_t, t)|\delta) + qr_t\} = 0, \quad \forall \tilde{\pi}_t \in (0, +\infty), t \in \{1, 2\} \tag{$\mathbf{IC}_1$}$$

$$L_d = 1 \qquad \Leftrightarrow \qquad \int_{-\infty}^{+\infty} u_1^m f(\tilde{\pi}_1|\mu_{l1}) d\tilde{\pi}_1 + I_\delta \int_{-\infty}^{+\infty} u_2^m f(\tilde{\pi}_2|\mu_{l2}) d\tilde{\pi}_2 \geq$$
$$\int_{-\infty}^{+\infty} u_1^m f(\tilde{\pi}_1|\mu_{d1}) d\tilde{\pi}_1 + I_\delta \int_{-\infty}^{+\infty} u_2^m f(\tilde{\pi}_2|\mu_{d2}) d\tilde{\pi}_2$$

where: $\mu_{l1} = \tau + V_l \ , \ \mu_{l2} = \tau \ , \ \mu_{d1} = \tau \ , \ \mu_{d2} = \tau + V_d$ $(\mathbf{IC}_2)$

$$L_o = 0 \qquad \Leftrightarrow \qquad \int_{-\infty}^{+\infty} u_1^m f(\tilde{\pi}_1|\mu_o) d\tilde{\pi}_1 + I_\delta \int_{-\infty}^{+\infty} u_2^m f(\tilde{\pi}_2|\mu_o) d\tilde{\pi}_2 \geq$$
$$\int_{-\infty}^{+\infty} u_1^m f(\tilde{\pi}_1|\mu_{l1}) d\tilde{\pi}_1 + I_\delta \int_{-\infty}^{+\infty} u_2^m f(\tilde{\pi}_2|\mu_{l2}) d\tilde{\pi}_2$$

where: $\mu_o = \tau + V_o \ , \ \mu_{l1} = \tau + V_l \ , \ \mu_{l2} = \tau$ $(\mathbf{IC}_3)$

Proposition 1 presents the optimal managerial contract. The proof is provided in the appendix.

Proposition 1 *The optimal managerial contract is a* ***short-term linear contract***

with payment $y_1^*(\pi_1|\delta = 1) = q\pi_1$, *if profits are positive and zero otherwise.*

Before proceeding to the determination of the optimal control structure, we make a few notes on the form and interpretation of the managerial contract. The managerial contract is similar to a call option with exercise price zero. This is because it makes no payment to the manager, if profits are negative, and starts to pay-out when profits are positive. Moreover, the manager receives a constant proportion of the profits. The first part of the managerial contract is a direct implication of limited liability, while the second part is due to the ability of the manager to divert profits into private benefits.

More interestingly, the optimal managerial contract is a *short-term* contract. Even though this model represents a special example, nonetheless, the optimality of the short-term over the long-term contract is a result which is not provided by the current literature.[15] This result is due to the interplay of two forces: the commitment problem of the entrepreneur, whose solution requires "myopic" (front-loaded) incentives, and the agency costs caused by the release of control. Since the solution of the managerial moral hazard requires a profit-sharing arrangement, a two-period contract is costly for the entrepreneur in two ways, one direct and one indirect: (i) E concedes a fraction q of period-two profits in order to avoid the deadweight-loss generated by the manager's appropriation. (ii) Profit sharing reduces the manager's incentives to liquidate the project at $\tilde{t}$, because liquidation reduces the expected value of her second-period payment. Thus E may need to increase period-one profit sharing above q to compensate for satisfying the manager's "liquidation-when-delay" incentive compatibility. The

[15] To be more precise, the existing literature examines the efficiency properties of long-term contracts vis-á-vis a sequence of short terms contracts and finds that either long-term contracts are superior to a sequence of short-term contracts (Shavell, 1979; Laffont and Tirole, 1988; Thadden, 1995) or that the two classes are equivalent (Fudenberg, Holmstrom, and Milgrom, 1990). So the result of this paper is not directly comparable to them. But if one extends the model of section 2 to a setting in which the entrepreneur receives the opportunity to invest in a new project in every period, each one of which may be delayed, then the optimal solution involves *a sequence of managers*, each one of whom receives the one-period contract of proposition 1. Since this is not the main focus of the paper, we do not provide this result formally.

one-period contract avoids both these costs and thus dominates over the two-period contract. Note that the result requires both forces to be at play, because, in the absence of the commitment problem E would not hire M ("zero" contract duration), while in the absence of profit appropriation, the optimal short-term and long-term contracts would be equivalent.

3.3 Optimal Control Structure and Comparative Statics

Let us now examine the value of the firm under the two ownership structures and the conditions under which the entrepreneur prefers to separate ownership from control. In the analysis that follows we consider the case, where (5) $\geq$ (3), so that E prefers to induce low effort, if she retains control. Thus, we can contrast the costs and benefits of the two ownership structures in terms of efficient provision of incentives for the worker versus managerial rents.

Therefore, if E retains the control of the firm at $t = 0$, she pays the minimum wage to the worker (in our model this is $w = 0$), she continues the project, even if it is delayed, and the firm's expected value (V^E) is equal to (5):

$$V^E = 2\tau + \underline{p}2V_o + (1 - \underline{p})V_d$$

On the other hand, if E separates ownership from control, then E provides the efficiency wage $\overline{w}_1$ to W and the contract of Proposition 1 to M at $t = 0$. At $t = \tilde{t}$, M liquidates the project only if it is delayed. Then the firm's expected value (V^M) to E is equal to:

$$V^M = 2\tau - \overline{p}\overline{w}_1 + \overline{p}\left[2V_o - q\int_0^{+\infty} \pi_1 f(\pi_1|\mu_o)d\pi_1\right] + (1 - \overline{p})\left[V_l - q\int_0^{+\infty} \pi_1 f(\pi_1|\mu_{l1})d\pi_1\right]$$

where: $\mu_o = \tau + V_o$ and $\mu_{l1} = \tau + V_l$. By directly comparing V^E to V^M, we see that E prefers to separate ownership from control iff:

$$2V_o(\overline{p} - \underline{p}) \geq (1 - \underline{p})V_d - (1 - \overline{p})V_l + \overline{p}\overline{w}_1 + E_\pi[y_1(\pi_1)] \tag{10}$$

where $E_\pi[y_1(\pi_1)]$ is the expected payment to the manager:

$$E_\pi[y_1(\pi_1)] = q\left[\overline{p}\int_0^{+\infty} \pi_1 f(\pi_1|\mu_o)d\pi_1 + (1-\overline{p})\int_0^{+\infty} \pi_1 f(\pi_1|\mu_{l1})d\pi_1\right]$$

Therefore, E separates ownership and control whenever the increase in the value of the project through the higher probability of completion on-time exceeds the efficiency wage to W and the expected value of rents to M. The comparative statics are directly derived from equation (10) and they are summarized in the following corollary (see the appendix for the proof):

Corollary 1 *The entrepreneur is more likely to separate ownership from control if:*

- *The ability of the manager to appropriate profits (q) decreases.*
- *The value of the completed project (V_o) increases.*
- *The differential impact of effort on incentives ($\Delta p = \overline{p} - \underline{p}$) increases.*
- *The efficiency wage $\overline{w}_1$ decreases, either because Δp increases or because $\overline{c}$ decreases.*
- *The variance of the firm profits (σ^2) decreases.*

The interpretation of most of these comparative statics is straightforward. We briefly comment on the relation between profit variability and separation of ownership and control. An increase in the variance of profits (σ^2) increases the expected payment to the manager, $E[y_1(\pi_1)]$, and decreases the value of separation of ownership and control. This is because an increase in σ^2 makes high-profit states more likely. Since the managerial reward is an increasing function of profits, so as to prevent rent extraction, higher variance increases the expected reward of the manager and, hence, the expected cost for the entrepreneur. Thus firms with higher profit variability are less likely to separate ownership and control, a prediction which is consistent with the findings of Demsetz and Lehn (1985).

4 Conclusion

This paper presents a simple model of strategic delegation from an entrepreneur to a manager, which can be interpreted as a model of separation of ownership and control. The main reasoning behind the model is that managers liquidate delayed projects more credibly than entrepreneurs, because, by the construction of their contract, they care less about the long-term value of the firm than its owners. Thus, they provide incentives to workers to exert high effort, complete projects on-time and generate firm value. On the other hand, the introduction of managers in the firm generates agency costs in the form of appropriation of profits for the provision of private benefits to the top management. This trade-off between low-tier and higher-tier benefits characterizes the optimal choice of control structure.

The model's main prediction is that firms with higher profit variability are less likely to separate ownership from control, which is consistent with the findings of the empirical literature. The model is also consistent with an expanding literature in management, which shows that entrepreneurs care more about the long-term prospects of their firms and tend to foster long-term relationships with their customers and employees.

Finally, we believe that the model offers some insights on why managers have endogenously determined short-term planning horizons, which induce "myopic" incentives. This is a feature of firm behavior that has attracted a lot of criticism by popular media, but it is still not well understood. Therefore, we believe that more research can be done on this. In particular, it would be interesting to generalize the model to a multi-period setting where recurring commitment problems interact with a dynamic moral hazard problem. In this setting, one can analyze the trade-off between short-term and long-term managerial incentives to derive a new model of optimal contract duration. This direction is currently being investigated.

Appendix

Optimal Wage Contracts

(a) Suppose that E wants to induce W to exert high effort. First, consider the case when E does not liquidate after delay: $L_d = 0$. E's problem is to maximize her expected return subject to the incentive compatibility constraint of W:

$$\max_{\mathbf{w}} \quad \overline{p}\left[2(\tau + V_o) - \int_{-\infty}^{+\infty} w(\pi_1, 1) f(\pi_1|\mu_o) d\pi_1\right]$$

$$+(1-\overline{p})\left[2\tau + V_d - \int_{-\infty}^{+\infty} w(\pi_1, 1) f(\pi_1|\mu_{d1}) d\pi_1 - \int_{-\infty}^{+\infty} w(\pi_2, 2) f(\pi_2|\mu_{d2}) d\pi_2\right]$$

subject to:

$$\overline{p}\left[b + \int_{-\infty}^{+\infty} u[w(\pi_1, 1)] f(\pi_1|\mu_o) d\pi_1\right]$$
$$+(1-\overline{p})\left[2b + \int_{-\infty}^{+\infty} u[w(\pi_1, 1)] f(\pi_1|\mu_{d1}) d\pi_1 + \int_{-\infty}^{+\infty} u[w(\pi_2, 2)] f(\pi_2|\mu_{d2}) d\pi_2\right] - \overline{c} \quad \geq$$

$$\underline{p}\left[b + \int_{-\infty}^{+\infty} u[w(\pi_1, 1)] f(\pi_1|\mu_o) d\pi_1\right]$$
$$+(1-\underline{p})\left[2b + \int_{-\infty}^{+\infty} u[w(\pi_1, 1)] f(\pi_1|\mu_{d1}) d\pi_1 + \int_{-\infty}^{+\infty} u[w(\pi_2, 2)] f(\pi_2|\mu_{d2}) d\pi_2\right]$$

Note that in the above problem if W's incentive compatibility constraint is satisfied then the participation constraint is also satisfied. This is because limited liability implies that $w(\pi_t, t) \geq 0$ so that the right-hand side of the incentive compatibility constraint is strictly positive. Therefore, we can omit the participation constraint from the analysis that follows. W's incentive compatibility condition can be rewritten as:

$$\int_{-\infty}^{+\infty} u[w(\pi_1, 1)][f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1})] d\pi_1 - \int_{-\infty}^{+\infty} u[w(\pi_2, 2)] f(\pi_2|\mu_{d2}) d\pi_2 \ \geq \ \frac{\overline{c}}{\overline{p} - \underline{p}} + b$$

The derivative of the Lagrangian for this problem with respect to $w(\pi_2, 2)$ is negative, hence the optimal wage for period two is zero: $\hat{w}(\pi_2, 2) = 0$. With respect to $w(\pi_1, 1)$, we have:

$$\frac{\partial L}{\partial w(\pi_1, 1)} = -\overline{p} f(\pi_1|\mu_o) - (1-\overline{p}) f(\pi_1|\mu_{d1}) + \lambda u'(w)[f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1})]$$

If $f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1}) \leq 0$, then the above expression is negative so that, by limited liability, $w(\pi_1, 1) = 0$. If $f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1}) > 0$, then the optimal wage contract is derived by setting the Langrangian equal to zero and solving for $w(\pi_1, 1)$. This gives the following expression:

$$w(\pi_1, 1) = (u')^{-1} \left[\frac{\overline{p} f(\pi_1|\mu_o) + (1 - \overline{p}) f(\pi_1|\mu_{d1})}{\lambda [f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1})]} \right] \tag{11}$$

Finally, the value of the Langrangian multiplier λ is derived by replacing the value of $w(\pi_1, 1)$ with either 0, if $f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1}) \leq 0$, or with the term in (11), if $f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1}) > 0$, and solving for λ in the incentive compatibility condition:

$$\int_{-\infty}^{+\infty} u[w(\pi_1, 1)][f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1})] d\pi_1 = \frac{\overline{c}}{\overline{p} - \underline{p}} + b \tag{12}$$

Note that because the inverse function of $u'(.)$ is strictly decreasing in its argument, the expression in (11) is a positive function of λ. This means that (12) is strictly increasing in λ so that a unique solution exists. Moreover, higher values of the right-hand side of (12) imply a higher value of λ. Let $\hat{\lambda}$ be the solution to (12). Then, the optimal wage contract $\hat{w}(\pi_1, 1)$ is characterised by:

$$\hat{w}(\pi_1, 1) = \begin{cases} (u')^{-1} \left[\frac{\overline{p} f(\pi_1|\mu_o) + (1 - \overline{p}) f(\pi_1|\mu_{d1})}{\hat{\lambda} [f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1})]} \right] & \text{if } f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1}) > 0 \\ 0 & \text{if } f(\pi_1|\mu_o) - f(\pi_1|\mu_{d1}) \leq 0 \end{cases} \tag{13}$$

(b) Similarly, for the case when E liquidates after delay ($L_d = 1$):

$$\max_{\mathbf{w}} \quad \overline{p} \left[2(\tau + V_o) - \int_{-\infty}^{+\infty} w(\pi_1, 1) f(\pi_1|\mu_o) d\pi_1 \right] + (1 - \overline{p})(2\tau + V_l)$$

subject to:

$$\int_{-\infty}^{+\infty} u[w(\pi_1, 1)] f(\pi_1|\mu_o) d\pi_1 \ \geq \ \frac{\overline{c}}{\overline{p} - \underline{p}}$$

The first order derivative with respect to $w(\pi_1, 1)$ is equal to:

$$\frac{\partial L}{\partial w(\pi_1, 1)} = -\overline{p} f(\pi_1|\mu_o) + \lambda u'(w) f(\pi_1|\mu_o)$$

By setting the above expression equal to zero and rearranging, we get:

$$u'[w(\pi_1, 1)] = \frac{\overline{p}}{\lambda}$$

The right-hand side of the above equation is constant, implying that $w(\pi_1, 1)$ is a constant, say $\overline{w}_1$. Hence:

$$\int_{-\infty}^{+\infty} u(\overline{w}_1) f(\pi_1|\mu_o) d\pi_1 = \frac{\bar{c}}{\overline{p} - \underline{p}} \Rightarrow \tag{14}$$

$$\overline{w}_1 = u^{-1}\left(\frac{\bar{c}}{\overline{p} - \underline{p}}\right)$$

(c) Finally, it is shown that E's expected payment to W under $L_d = 1$ is lower than under $L_d = 0$, which is equivalent to proving that:

$$\overline{p}\overline{w}_1 < \overline{p} \int_{-\infty}^{+\infty} \hat{w}(\pi_1, 1) f(\pi_1|\mu_o) d\pi_1 + (1 - \overline{p}) \int_{-\infty}^{+\infty} \hat{w}(\pi_1, 1) f(\pi_1|\mu_{d1}) d\pi_1$$

In the case where $L_d = 0$, because W's incentive compatibility is binding and $\hat{w}(\pi_2, 2) = 0$, we have:

$$\int_{-\infty}^{+\infty} u[\hat{w}(\pi_1, 1)] f(\pi_1|\mu_o) d\pi_1 - \int_{-\infty}^{+\infty} u[\hat{w}(\pi_1, 1)] f(\pi_1|\mu_{d1}) d\pi_1 = \frac{\bar{c}}{\overline{p} - \underline{p}} + b > \frac{\bar{c}}{\overline{p} - \underline{p}} \Rightarrow$$

$$\int_{-\infty}^{+\infty} u[\hat{w}(\pi_1, 1)] f(\pi_1|\mu_o) d\pi_1 > \frac{\bar{c}}{\overline{p} - \underline{p}}$$

Therefore, there exists some constant $x > 0$, such that:

$$\int_{-\infty}^{+\infty} u[\hat{w}(\pi_1, 1) - x] f(\pi_1|\mu_o) d\pi_1 = \frac{\bar{c}}{\overline{p} - \underline{p}}$$

But, this implies that the wage schedule $\hat{w}(\pi_1, 1) - x$ satisfies W's incentive compatibility when $L_d = 1$. However, as we showed in part (b), above, $\hat{w}(\pi_1, 1) - x$ is not optimal in that case, as it forces W to bear risk. Hence:

$$\overline{w}_1 < \int_{-\infty}^{+\infty} \hat{w}(\pi_1, 1) f(\pi_1|\mu_o) d\pi_1 - x < \int_{-\infty}^{+\infty} \hat{w}(\pi_1, 1) f(\pi_1|\mu_o) d\pi_1$$

The result follows from the above inequality and the fact that $\int_{-\infty}^{+\infty} \hat{w}(\pi_1, 1) f(\pi_1|\mu_{d1}) d\pi_1 > 0$.

Proof of Proposition 1

First we show that the optimal managerial contract is always a short-term contract. Then we solve for the optimal short-term contract.

Recall that $\mu_{st} = \tau + (1 - L_s)V_{st} + L_s V_{lt}$ is the mean of the random variable $\tilde{\pi}_t$ and that $\hat{\pi}_t = \tilde{\pi}_t - r_t(\tilde{\pi}_t)$, $\pi_t = \tilde{\pi}_t - r_t(\tilde{\pi}_t) - w(\hat{\pi}_t, t)$. I_δ is an indicator function which takes the value 1 if the contract is long-term and takes the value 0 if the contract is short-term. $u_t^m = y_t(\pi_t|\delta) + qr_t(\tilde{\pi}_t)$ is M's utility for a given realization of $\tilde{\pi}_t$. The three incentive compatibility conditions for the problem are:

$$arg\max_{r_t}\{y_t(\tilde{\pi}_t - r_t - w(\hat{\pi}_t, t)|\delta) + qr_t\} = 0, \quad \forall \tilde{\pi}_t \in (0, +\infty), t \in \{1, 2\} \qquad (\mathbf{IC}_1)$$

$$L_d = 1 \quad \Leftrightarrow \quad \int_{-\infty}^{+\infty} u_1^m f(\tilde{\pi}_1|\mu_{l1})d\tilde{\pi}_1 + I_\delta \int_{-\infty}^{+\infty} u_2^m f(\tilde{\pi}_2|\mu_{l2})d\tilde{\pi}_2 \geq \int_{-\infty}^{+\infty} u_1^m f(\tilde{\pi}_1|\mu_{d1})d\tilde{\pi}_1 + I_\delta \int_{-\infty}^{+\infty} u_2^m f(\tilde{\pi}_2|\mu_{d2})d\tilde{\pi}_2$$

where: $\mu_{l1} = \tau + V_l$, $\mu_{l2} = \tau$, $\mu_{d1} = \tau$, $\mu_{d2} = \tau + V_d$ $\qquad (\mathbf{IC}_2)$

$$L_o = 0 \quad \Leftrightarrow \quad \int_{-\infty}^{+\infty} u_1^m f(\tilde{\pi}_1|\mu_o)d\tilde{\pi}_1 + I_\delta \int_{-\infty}^{+\infty} u_2^m f(\tilde{\pi}_2|\mu_o)d\tilde{\pi}_2 \geq \int_{-\infty}^{+\infty} u_1^m f(\tilde{\pi}_1|\mu_{l1})d\tilde{\pi}_1 + I_\delta \int_{-\infty}^{+\infty} u_2^m f(\tilde{\pi}_2|\mu_{l2})d\tilde{\pi}_2$$

where: $\mu_o = \tau + V_o$, $\mu_{l1} = \tau + V_l$, $\mu_{l2} = \tau$ $\qquad (\mathbf{IC}_3)$

In order to show that short-term contracts dominate long-term contracts, first we analyze $\mathbf{IC}_1$. By differentiating $\mathbf{IC}_1$ with respect to r_t, we find that the manager is indifferent between extracting more rents or reporting the true profits if $\frac{\partial y_t}{\partial \pi_t} = q$. This means that the managerial contract is an increasing function of reported profits, with slope at least equal to q in order to prevent the manager from extracting private benefits.

Otherwise, the manager has the incentive to appropriate in the neighborhood of any realized profit where her contract is non-increasing. By doing so, she does not reduce her compensation while extracting private benefits for herself. Clearly, the expected payment is minimized when $y_t = q\pi_t$.

Consider any long-term contract $y^L = \{y_1(\pi_1|\delta = 2), y_2(\pi_2|\delta = 2)\}$ which satisfies **IC**$_1$-**IC**$_3$. We have established that y^L is increasing in profits in both periods. Consider now the short-term contract $y^S = \{y_1(\pi_1|\delta = 1) = y_1(\pi_1|\delta = 2)\}$. That is y^S offers the same payment schedule as y^L for the first period, after which the manager is fired. y^S offers a lower expected payment to M than y^L, since M receives no second period payment. Therefore, y^S strictly increases E's utility over y^L.

Furthermore, y^S also satisfies the incentive compatibility conditions. To see this, first, y^S satisfies **IC**$_1$ for period one by construction. Second, **IC**$_3$ is also satisfied (when we set $I_\delta = 0$), because the mean of the random variable $\tilde{\pi}_1$ is higher under continuation ($\mu_o = \tau + V_o$) than under liquidation ($\mu_{l1} = \tau + V_l$). Since the managerial contract is an increasing function of profits (by **IC**$_1$), the expected payment for the manager is higher when the mean of $\tilde{\pi}_t$ is higher. It remains to show that **IC**$_2$ is also satisfied by y^S. By substituting the values for μ_{st} in **IC**$_2$ and by rearranging, the constraint writes in the case of y^L as follows:

$$\int_{-\infty}^{+\infty} u_1^m \left[f(\tilde{\pi}_1|\tau + V_l) - f(\tilde{\pi}_1|\tau)\right] d\tilde{\pi}_1 \;\geq\; \int_{-\infty}^{+\infty} u_2^m \left[f(\tilde{\pi}_2|\tau + V_d) - f(\tilde{\pi}_2|\tau)\right] d\tilde{\pi}_2 \qquad (15)$$

Because **IC**$_1$ is satisfied, $r_2(\tilde{\pi}_2) = 0$. Therefore, since $\tau + V_d > \tau$ and u_2^m is an increasing function of $\tilde{\pi}_2$, the right hand side of (15) is strictly positive. However, in the case of the short-term contract, M receives no payment in period two, so $u_2^m = 0$ under a short-term contract and in this case (15) writes as:

$$\int_{-\infty}^{+\infty} u_1^m \left[f(\tilde{\pi}_1|\tau + V_l) - f(\tilde{\pi}_1|\tau)\right] d\tilde{\pi}_1 \;\geq\; 0 \qquad (16)$$

Therefore, if the long-term contract satisfies (15) then the left-hand side of both inequalities (15) and (16) are positive (since they are the same) and hence the short-term contract strictly satisfies (16). This means that y^S provides a smaller expected payment to M and it also strictly relaxes **IC**$_2$. Hence, any incentive compatible long-term contract is dominated by a short-term contract. For simplicity, we drop the notation δ and period three payments for the rest of the proof and we solve for the optimal short-term contract.

By limited liability, $y_1(\pi_1) = 0$ if $\pi_1 < 0$. By **IC**$_1$, $y_1(\pi_1) \geq q\pi_1$ if $\pi_1 \geq 0$. Consider the contract with the minimum-expected payment which satisfies **IC**$_1$ and limited liability:

$$y_1 = \begin{cases} 0, & \text{if } \pi_1 < 0 \\ q\pi_1, & \text{if } \pi_1 \geq 0 \end{cases} \tag{17}$$

We show that the above contract satisfies $\mathbf{IC}_2$-$\mathbf{IC}_3$. In evaluating M's utility from the above contract, we take into account that the optimal wage is set to $\overline{w}_1$ by E, which is constant. By substituting the above payments for u_1^m in (16), $\mathbf{IC}_2$ writes as:

$$q \int_0^{+\infty} \pi_1 \left[f(\pi_1|\mu_{l1}) - f(\pi_1|\mu_{d1})\right] d\pi_1 \;\geq\; 0$$

Now, because $\frac{\partial}{\partial\mu}\left[\int_0^{+\infty} \pi_1 f(\pi_1|\mu) d\pi_1\right] > 0$ and $\mu_{l1} = \tau + V_l > \mu_{d1} = \tau$, the left-hand side of the above inequality is strictly positive and $\mathbf{IC}_2$ is satisfied. Similarly for $\mathbf{IC}_3$:

$$q \int_0^{+\infty} \pi_1 \left[f(\pi_1|\mu_o) - f(\pi_1|\mu_{l1})\right] d\pi_1 \;\geq\; 0$$

Because $V_o > V_d$, $\mu_o = \tau + V_o > \mu_{l1} = \tau + V_l$. So the left-hand side of the above inequality is strictly positive and $\mathbf{IC}_3$ is satisfied as well. Therefore, the contract in (17) minimizes the rents paid to M due to $\mathbf{IC}_1$ and also satisfies $\mathbf{IC}_2$ and $\mathbf{IC}_3$. Hence, (17) is the optimal managerial contract. ■

Proof of Corollary 1

The net benefit (denoted by NB) of separation of ownership and control is:

$$NB \equiv 2V_o(\overline{p} - \underline{p}) - (1 - \underline{p})V_d + (1 - \overline{p})V_l - \overline{p}\overline{w}_1 - E_\pi[y_1(\pi_1)] \tag{18}$$

where,

$$E_\pi[y_1(\pi_1)] = q\left[\overline{p}\int_0^{+\infty} \pi_1 f(\pi_1|\mu_o) d\pi_1 + (1 - \overline{p})\int_0^{+\infty} \pi_1 f(\pi_1|\mu_{l1}) d\pi_1\right]$$

(i) First, it is shown that NB increases if q decreases. By differentiating (18) with respect to q we get:

$$\frac{\partial NB}{\partial q} = -\left[\overline{p}\int_0^{+\infty}\pi_1 f(\pi_1|\mu_o)d\pi_1 + (1-\overline{p})\int_0^{+\infty}\pi_1 f(\pi_1|\mu_{l1})d\pi_1\right] < 0$$

(ii) Next, it is shown that NB is increasing in V_o. By differentiating (18) with respect to V_o we get:

$$\frac{\partial NB}{\partial V_o} = 2(\overline{p}-\underline{p}) - q\overline{p}\frac{\partial}{\partial V_o}\left[\int_0^{+\infty}\pi_1 f(\pi_1|\mu_o)d\pi_1\right]$$

Note that $\int_0^{+\infty}\pi_1 f(\pi_1|\mu_o)d\pi_1$ can also be written as $\int_{\overline{w}_1-V_o}^{+\infty}(\rho_1+V_o-\overline{w}_1)f(\rho_1)d\rho_1$. By differentiating this expression by V_o and by doing some algebra we get:

$$\frac{\partial}{\partial V_o}\left[\int_{\overline{w}_1-V_o}^{+\infty}(\rho_1+V_o-\overline{w}_1)f(\rho_1)d\rho_1\right] = 1-F(\overline{w}_1-V_o)$$

Therefore:

$$\frac{\partial NB}{\partial V_o} = 2(\overline{p}-\underline{p}) - q\overline{p}[1-F(\overline{w}_1-V_o)] \Leftrightarrow$$

$$\frac{\partial NB}{\partial V_o} = \overline{p}-\underline{p}+\overline{p}\,[1-q+qF(\overline{w}_1-V_o)] > 0$$

(iii) The third comparative static is with respect to $\overline{p}-\underline{p}$. We show that NB is increasing in $\overline{p}$ and decreasing in $\underline{p}$ so that it is increasing in their difference. By differentiating NB with respect to $\overline{p}$ we get:

$$\frac{\partial NB}{\partial \overline{p}} = 2V_o-V_l-\overline{w}_1-\overline{p}\frac{\partial \overline{w}_1}{\partial \overline{p}}+q\overline{p}\frac{\partial \overline{w}_1}{\partial \overline{p}}[1-F(\overline{w}_1-V_o)]-q\left[\int_0^{+\infty}\pi_1 f(\pi_1|\mu_o)d\pi_1 - \int_0^{+\infty}\pi_1 f(\pi_1|\mu_{l1})d\pi_1\right]$$

The term $q\overline{p}\frac{\partial \overline{w}_1}{\partial \overline{p}}[1-F(\overline{w}_1-V_o)]$ reflects the effect of a change of $\overline{p}$ to $E_\pi[y_1(\pi_1)]$ through a change in $\overline{w}_1$, while the last term of the above expression can be rewritten as:

$$\int_0^{+\infty}\pi_1 f(\pi_1|\mu_o)d\pi_1-\int_0^{+\infty}\pi_1 f(\pi_1|\mu_{l1})d\pi_1 = \int_{\overline{w}_1-V_o}^{+\infty}(\rho_1+V_o-\overline{w}_1)f(\rho_1)d\rho_1-\int_{-V_l}^{+\infty}(\rho_1+V_l)f(\rho_1)d\rho_1 =$$

$$V_o-\overline{w}_1-V_l-F(\overline{w}_1-V_o)(V_o-\underline{w_1})+F(-V_l)V_l-\int_{\overline{w}_1-V_o}^{-V_l}\rho_1 f(\rho_1)d\rho_1 =$$

$$V_o - \overline{w}_1 - V_l + 2F(-V_l)V_l - 2F(\overline{w}_1 - V_o)(V_o - \overline{w}_1) - \int_{\overline{w}_1 - V_o}^{-V_l} F(\rho_1)d\rho_1$$

The last equation was derived by integration by parts of the term $\int_{\overline{w}_1-V_o}^{-V_l} \rho_1 f(\rho_1)d\rho_1$. By replacing this term to the original equation and by doing some algebra we get the following expression:

$$\frac{\partial NB}{\partial \overline{p}} = (1-q)(V_o - V_l - \overline{w}_1) + V_o - 2qF(-V_l)V_l + q\left[2F(\overline{w}_1 - V_o)(V_o - \overline{w}_1) + \int_{\overline{w}_1-V_o}^{-V_l} F(\rho_1)d\rho_1\right] - \overline{p}\frac{\partial \overline{w}_1}{\partial \overline{p}}[1 - q + qF(\overline{w}_1 - V_o)]$$

Note that $V_o - V_l - \overline{w}_1 > 0$, because of condition (8) and the fact that $V_o > V_d$. Also, since $-V_l < 0 < \tau$, $F(-V_l) < 1/2$, which implies that $2qF(-V_l)V_l < V_l$. Hence $V_o - 2qF(-V_l)V_l > 0$. Finally, because $\frac{\partial \overline{w}_1}{\partial \overline{p}} < 0$, the last term of the expression is positive. Therefore all the terms on the right hand side of the above expression are positive and so $\frac{\partial NB}{\partial \overline{p}} > 0$.

By taking the derivative of NB with respect to $\underline{p}$ we have:

$$\frac{\partial NB}{\partial \underline{p}} = -2V_o + V_d - \overline{p}\frac{\partial \overline{w}_1}{\partial \underline{p}} + q\overline{p}[1 - F(\overline{w}_1 - V_o)]\frac{\partial \overline{w}_1}{\partial \underline{p}} < 0$$

Because $\frac{\partial \overline{w}_1}{\partial \underline{p}} > 0$, $V_o > V_d$ and $q[1 - F(\overline{w}_1 - V_o)] < 1$, the above expression is negative. Overall, NB is increasing in $\overline{p}$, decreasing in $\underline{p}$ and therefore increasing in their difference.

(iv) The fourth comparative static is with respect to $\overline{w}_1$.

$$\frac{\partial NB}{\partial \overline{w}_1} = -\overline{p}\,[1 - q[1 - F(\overline{w}_1 - V_o)]] < 0$$

The above expression combines the direct effect of $\overline{w}_1$ on NB and its indirect effect through $E_\pi[y_1(\pi_1)]$. The direct effect dominates the indirect effect so that an increase in $\overline{w}_1$ decreases NB. Moreover, since $\overline{w}_1 = u^{-1}\left(\frac{\overline{c}}{\overline{p}-\underline{p}}\right)$, $\overline{w}_1$ is increasing in $\overline{c}$ and $\underline{p}$ and decreasing in $\overline{p}$.

(v) A change in σ affects only the last term of NB, $E_\pi[y_1(\pi_1)]$. Because (i) NB is decreasing in $E_\pi[y_1(\pi_1)]$, (ii) $E_\pi[y_1(\pi_1)]$ is a weighted sum of the expected values of truncated normal distributions, and (iii) the expected mean of a truncated normal distribution is increasing in its variance, we have:

$$\frac{\partial NB}{\partial \sigma} \; < \; 0$$

Therefore a decrease in σ leads to an increase in NB.

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