LARGE SHAREHOLDERS, MONITORING, AND THE VALUE OF THE FIRM*

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We propose that dispersed outside ownership and the resulting managerial discretion come with costs but also with benefits. Even when tight control by shareholders is ex post efficient, it constitutes ex ante an expropriation threat that reduces managerial initiative and noncontractible investments. In addition, we show that equity implements state contingent control, a feature usually associated with debt. Finally, we demonstrate that monitoring, and hence ownership concentration, may conflict with performance-based incentive schemes.

I. INTRODUCTION

This paper challenges the notion that the reduction of managerial discretion by large outside shareholders is purely beneficial.[1] It argues that constraints on managers through monitoring may also be costly precisely because managerial discretion comes with benefits. More precisely, even if managerial discretion is ex post detrimental to shareholders, it can be beneficial ex ante as

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1. In a sample of Japanese chemical firms, Yafeh and Yosha [1995] find that expenditures on activities with high potential for managerial moral hazard such as advertising, R&D, and entertainment expenses are significantly negatively correlated with shareholder concentration. For example, a 10 percent concentration increase is associated with a reduction of over $50 million in R&D outlays. Moreover, they show that monitoring by large shareholders takes place continuously, even outside financial distress. Many studies examine the indirect impact of monitoring, e.g., on stock prices. See Shleifer and Vishny [1997] and the references therein.

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it favors firm-specific investment, like searching for new investment projects. The manager is less inclined to show such initiative when shareholders are likely to interfere. Hence, to the extent that managerial initiative (or any firm-specific investment) contributes to firm value, there is a trade-off between the gains from monitoring and those from managerial initiative. We propose that a firm's ownership structure can act as a commitment device to delegate a certain degree of control to management. For instance, a dispersed ownership structure assures the manager that shareholders will interfere little, inducing him to show initiative. This gain has to be weighed against the loss in control due to inadequate monitoring. Conversely, a concentrated ownership structure induces high levels of monitoring and control but renders management less active. Hence, the ownership structure is an instrument to solve the trade-off between control and initiative because it determines the shareholders' incentives to monitor. To put it differently, we suggest that one problem with outside voting equity is the difficulty it has in committing *not* to exercise its control rights. The ownership structure can alleviate this problem by limiting the shareholders' incentives to exercise these rights.

As regards the trade-off between control and initiative, some robustness issues arise. First, we show that monetary incentives do not generally render monitoring redundant. This is best understood when insiders derive large private benefits from discretion. In this case, large monetary compensations are needed to align interests, while even little discretion will induce initiative because the expected private gains remain large. Second, we address the issue of the block's stability to retrading. Once the manager's effort is sunk, a purchase by the large shareholder increases share value. Nonetheless, this gain will not materialize because dispersed shareholders retain their shares unless the price matches the posttrade share value. Consequently, the bid price does not compensate the block-holder ex ante for the increased monitoring cost that she will incur ex post due to her enlarged stake. Hence, she will not trade.

We then study three extensions. First, we consider the outside ownership structure chosen by the firm's initial owner. Due to the trade-off between control and initiative, the amount of capital that can be raised need not be monotonic in the concentration of outside equity. This is internalized by the initial owner. Nevertheless, he will generally choose a more dispersed structure than the one that maximizes the capital raised. Indeed, the entrepreneur is willing to bear a lower share price, because a more dispersed outside ownership grants him more effective control and higher private gains. This holds even if private gains are inefficient. In this case, the entrepreneur would like to commit not to consume them. Yet, too large a shareholder might incur a marginal monitoring cost greater than the inefficiency avoided.[2]

Second, we propose that equity confers state contingent control, a feature generally associated with debt in the literature. Furthermore, the set of states in which outsiders exercise control is determined by the ownership concentration. For example, a more dispersed ownership structure triggers shareholder intervention only in states where the gains from exercising control are large.

Third, the trade-off between control and initiative can be interpreted as one between the provision of incentives through *performance-based evaluation* and a more accurate, *direct evaluation* of the firm's prospects. A manager's incentives to signal his quality, say, by producing high short-term profits, depend on how this performance affects his prospects of retaining the job. These incentives are maximized in a widely held company because the retention decision is based on the signal. In contrast, direct evaluation by a large shareholder reduces the signal's value, and hence the manager's incentives to exert effort.

Apart from monitoring, large shareholders can be beneficial by reducing the free-rider problem in takeovers [Shleifer and Vishny 1986] or by challenging outside raiders, thus increasing the takeover premium [Burkart 1995]. More importantly for this paper, other theories also suggest costs of outside ownership concentration. Block-holders might forgo some risk diversification gains [Demsetz and Lehn 1985][3] or promote their own interest at the expense of other shareholders [Shleifer and Vishny 1997]. By reducing the stock's liquidity, large blocks might also inhibit information production in the stock market [Holmstrom and Tirole 1993]. Furthermore, aggressive counterbidding by incumbent

2. This effect is also described in Pagano and Röell [1995].

3. The underdiversification argument implies that any firm which is not fully concentrated constitutes unexploited profit opportunities. By merging their funds, two (institutional) investors could hold their risk-exposure constant while increasing their ownership stake, thereby exploiting the benefits of increasing monitoring. Moreover, the high levels of ownership concentration observed worldwide suggest that the lack of diversification is not the dominant concern of large investors.

block-holders might reduce the probability of takeover attempts [Burkart 1995]. We abstract from these effects and focus on the conflicting effects of monitoring. To this end, we consider risk-neutral shareholders with perfectly congruent interests and rule out takeovers and market monitoring. In addition, we derive empirical implications that help to distinguish our theory from others.

Our paper builds on the property rights literature developed by Grossman and Hart [1986] and Hart and Moore [1990]. It argues that parties without ownership may be discouraged from undertaking asset-specific investments because the owners of the asset can use their control rights to hold them up. This theory, however, cannot capture the separation of ownership and control precisely because it equates these two concepts. Following Aghion and Tirole [1997], we suggest that *control rights* translate into *effective control* only when their holders have the incentives to exercise them. We argue that the ownership structure is a powerful technology to allocate effective control in a way that mitigates the holdup problem.

Several papers show how an investor's inability to commit to abstain from rent extraction has adverse effects on the agent's incentives. In Rajan [1992] and von Thadden [1995], her informational monopoly allows a firm's exclusive lender to dictate the terms of continuation finance, thus distorting the firm's investment choice. Shleifer and Summers [1988] propose that hostile takeovers are a means to extract stakeholders' ex post rent by removing managers committed to uphold implicit contracts. The papers closest to ours are Acemoglu [1995] and Myers [1996] which independently analyze the trade-off between the benefits of tighter control and lower incentives for insiders associated with outside ownership concentration. Both are free cash flow frameworks with exogenous costs of exercising control. The argument about competing evaluation systems builds on Crémer's [1995] work. He analyzes a principal's trade-off between solving a moral hazard problem by remaining uninformed about his agent's type, and solving an adverse selection problem by becoming informed. The principal is assumed to be able to commit to his choice. In our paper the firm's ownership structure constitutes a commitment technology that balances the conflicting effects of information acquisition optimally.

Section II presents the trade-off between control and initiative. Section III examines robustness issues. Section IV analyzes an entrepreneur's decision to go public. Section V illustrates how contingent control is implemented with equity. Section VI rephrases the trade-off as one between direct and performance-based evaluation. Section VII concludes.

II. Monitoring versus Managerial Initiative

II.A. The Model

Consider a firm run by a risk-neutral manager who, for simplicity, owns no shares. A fraction α of shares is held by a single outside investor, while $(1 - \alpha)$ are dispersed among small shareholders. Equity-holders have a cash flow claim and *control rights,* i.e., the right to make decisions. All shareholders are risk-neutral and have perfectly congruent objectives. Risk-neutrality and perfect congruence of interests allow us to ignore potential efficiency costs due to the block-holder being underdiversified or exercising control at the expense of other shareholders.

The firm faces $N + 1$ projects, $i \in \{0, 1, 2, \ldots, N\}$, yielding verifiable security benefits Π^i to the shareholders and nonverifiable private benefits b^i to the manager. Although the project choice is observable by informed parties, it is not verifiable. Project 0 is known, and $\Pi^0 = b^0 = 0$. The N other projects cannot be distinguished from each other without further investigation. $(N - 2)$ projects yield $\Pi^i < 0$ and $b^i < 0$, and at least one of them is very bad in that $b^i = \Pi^i = -\infty$.[4] The other two projects, indexed $N - 1$ and N, have the following payoffs:

project $N - 1$	project N	probability
$\{\Pi, b\}$	$\{0, 0\}$	λ
$\{\Pi, 0\}$	$\{0, b\}$	$1 - \lambda$

where $\Pi > 0$ and $b > 0$.

Thus, λ measures the congruence of interests between the manager and the shareholders. When $\lambda = 1$, there is perfect congruence of interests, and the ownership structure becomes irrelevant. We exclude this possibility and focus on situations where agency problems exist.

4. This extreme assumption is not necessary. It suffices that expected security and private benefits are sufficiently smaller than those generated by project 0.

ASSUMPTION 1. $\lambda < 1$.

At date 1 the manager chooses to exert a nonverifiable effort $e \in [0,1]$ at a cost $e^2/2$. This enables him to learn at date 2 the payoffs of all projects with probability e. More generally, the manager's effort e could be thought of as any noncontractible firm-specific investment, which increases firm value. At date 1 each shareholder can exert a nonverifiable monitoring effort $E \in [0,1]$ at a cost $E^2/2$. We assume the following monitoring technology. If the manager becomes informed at date 2, the shareholder is also informed with probability E, but remains uninformed with probability $(1 - E)$. If the manager remains uninformed, so do the shareholders. Thus, monitoring is contemporaneous with the manager's effort, but is effective only if the manager's search is successful.[5]

At date 2 the shareholders either choose a project or delegate this decision to the manager. Note that there is no decision problem among shareholders due to their congruent interests. At date 3 the payoffs are realized.

II.B. The Costs and Benefits of Ownership Concentration

To highlight our main point, we initially abstract from monetary incentives. This simplifying assumption is relaxed in subsection III.A.[6] Moreover, compensation schemes based on project choice are not feasible due to the nonverifiability of projects. Hence, no contract ensures that an informed manager always chooses the shareholders' preferred project.[7]

At date 2 the project will thus be chosen as follows. Due to the free riding by small shareholders (say due to a small opportu-

5. Our results are robust to variations in the monitoring technology. First, we could remove the assumption that the manager is always weakly better informed than the shareholders, i.e., allow shareholders to acquire information even when the manager is uninformed. The only additional feature is the manager's greater incentive to shirk as he can free ride on the shareholders' search effort [Burkart, Gromb, and Panunzi 1995a]. Second, monitoring could occur after the manager has searched, rather than simultaneously. The chosen version allows for closed-form solutions with and without monetary incentives.

6. The use of effective monetary incentive schemes has been questioned in several empirical studies. Jensen and Murphy [1990] find that cash compensation changes CEO wealth by about 30 cents per $1000 of contemporaneous change in shareholder wealth, suggesting weak monetary incentives for managers. Moreover, Yermack [1995] shows that managers receive stock options shortly before good news announcements and after bad news announcements, suggesting that options may be less an incentive device than a perk.

7. For instance, schemes in which the manager is penalized if his project proposal does not match the large shareholder's choice are not feasible.

nity cost of monitoring), only the large shareholder engages in monitoring. Three cases arise. First, if the shareholders and the manager are uninformed, they agree to undertake project 0 due to the assumed lower expected return of randomly choosing one of the N other projects. Second, if only the manager is informed, shareholders follow his recommendation. He chooses his preferred project that yields b to him with certainty and Π to the shareholders with probability λ. Third, if both the manager and the block-holder are informed, the latter exercises her *control right.* She implements her preferred project that yields Π to the shareholders with certainty and b to the manager with probability λ.

The model illustrates that while shareholders have *control rights,* many decisions are delegated to management who thus enjoys a certain degree of discretion, or *effective control.*[8] The allocation of effective control within the firm will generally differ from that of statutory control rights. This discrepancy may be due to asymmetric information. Shareholders are entitled to reverse the manager's decision but refrain from doing so when the latter has superior information. The manager then has effective control although no control rights.

Given E, the manager maximizes

$$(1 - e) \cdot 0 + e \cdot [E\lambda b + E(1 - \lambda)0 + (1 - E)b] - e^2/2.$$

With probability $(1 - e)$ he remains uninformed, and project 0 is undertaken yielding $b^0 = 0$. With probability eE he and the blockholder are informed, and the latter exercises her control right. Her preferred project is implemented, which yields an expected gain of λb to the manager. With probability $e(1 - E)$ only the manager is informed. He exercises effective control and receives b. The FOC gives

$$e = \min \{b \cdot [1 - (1 - \lambda)E]; 1\}.$$

The manager's effort to become informed, his initiative, depends on the likelihood of having effective control. Hence, close monitoring by the large shareholder inhibits managerial initiative. This is an instance of the holdup problem: the manager can increase firm value by exerting effort, but his incentives are reduced by

8. Aghion and Tirole [1997] distinguish between the concepts of "formal authority" and "real authority" in organizations, which we paraphrase as "control rights" and "effective control."

the risk that the large shareholder might prevent him from receiving his private benefits.[9]

Consider now the large shareholder's monitoring effort. Given e, she maximizes

$$(1 - e) \cdot \alpha \cdot 0 + e \cdot [E\alpha\Pi + (1 - E)\alpha\lambda\Pi] - E^2/2.$$

Because she holds the control rights (all other shareholders agree with her), she exercises effective control when, but only when, she is informed. The FOC gives

$$E = \min \{\alpha\Pi(1 - \lambda)e; 1\}.$$

For a given e the large shareholder's effort increases with the size of her stake because she can reap a larger share of the benefits generated by monitoring.

We can now solve for E and e in the FOCs. The following assumption ensures that interior solutions obtain.

ASSUMPTION 2. $b < 1$, and $\Pi b < 1/\lambda(1 - \lambda)$.

We thus get

$$E(\alpha) = \frac{\alpha\Pi b(1 - \lambda)}{1 + \alpha\Pi b(1 - \lambda)^2} \quad \text{and} \quad e(\alpha) = \frac{b}{1 + \alpha\Pi b(1 - \lambda)^2}.$$

Consider net equity value, i.e., expected security benefits net of monitoring costs. This is the amount that could be raised by selling all shares to outsiders.[10]

$$V = e[\lambda + (1 - \lambda)E]\Pi - E^2/2.$$

Taking the derivative with respect to α yields

$$(1) \quad \frac{\partial V}{\partial \alpha} = \frac{\partial E}{\partial \alpha} \cdot [e(1 - \lambda)\Pi - E] + \frac{\partial e}{\partial \alpha} \cdot [\lambda + (1 - \lambda)E]\Pi.$$

Ownership concentration has benefits and costs. On the one hand, the first term in (1) is positive due to $\partial E(\alpha)/\partial\alpha > 0$. As the large shareholder's stake increases, she monitors more intensely. This *control effect,* net of monitoring costs, is beneficial ex post

9. We do not mean that all forms of monitoring will inhibit effort. Monitoring could be checking whether effort was exerted. However, our focus is on the costs of monitoring.

10. To raise the amount V, the entrepreneur could price discriminate between large and small shareholders, by placing the block privately at a discount (as documented in Hertzel and Smith [1993]). However, Brennan and Franks [1996] argue that IPO underpricing is used to ensure oversubscription and rationing so as to limit the concentration of new shareholdings.

because the shareholders' preferred project is more likely to be undertaken. On the other hand, the second term is negative due to $\partial e(\alpha)/\partial\alpha < 0$. Indeed, the large shareholder's tighter grip on the decision process reduces the manager's initiative ex ante because he is less likely to have effective control ex post. This *initiative effect* constitutes the cost of ownership concentration. Despite diverging interests, managerial initiative contributes to the equity value. Consequently, maximizing value may require commitment to leave some effective control to the manager. Since neither the project choice nor monitoring are contractible, voting equity faces a time consistency problem. It cannot commit ex ante not to use its control rights in situations where it finds it ex post optimal to exercise them. The more dispersed the ownership, however, the more often shareholders find it optimal ex post to delegate decisions to management. In that respect, the ownership structure constitutes a commitment not to exercise control rights. We find that the value of equity net of monitoring cost is nonmonotonic in ownership concentration.[11]

PROPOSITION 1. Net equity value $V(\alpha)$ is concave in α and maximized when a fraction α_1^* is allocated to a large shareholder and the remaining $(1 - \alpha_1^*)$ to dispersed small shareholders, where

$$0 < \alpha_1^* = \frac{1}{1/(1-\lambda) + \Pi b(1-\lambda^2)} < 1.$$

Proof of Proposition 1. See Appendix.

We obtain the following comparative-static results.

COROLLARY 1. α_1^* is decreasing in Π and b. $E(\alpha_1^*)$ is increasing in Π and b.

A larger Π increases the blockholder's incentive to monitor. For a given α such an increase results in less initiative by the manager. A larger b increases the manager's opportunity cost when being overruled by the large shareholder. This increases

11. The model assumes a unique large block-holder, in accordance with empirical findings [Zwiebel 1995]. Yet, any level of monitoring could also obtain with several block-holders. When sticking closely to the model, the optimality of one versus more block-holders depends on the trade-off between the duplication of monitoring and the convexity of monitoring costs. Note that duplication and free riding among block-holders will require that the sum of their stakes be greater than that of a single block-holder for the same level of supervision.

the deterrence effect of monitoring at the margin; i.e., $|\partial e/\partial E|$ increases. In both cases, the net equity value is increased if shareholders are committed to lower levels of monitoring by reducing the ownership concentration.

The optimal ownership concentration in Proposition 1 also depends on the monitoring cost of the large shareholder. Since this private cost is most likely difficult to measure, an empirical examination of Proposition 1 does not seem promising. Hence, for the purpose of deriving some testable implications of our theory, we now consider equity value (i.e., excluding monitoring costs):

$$W = e[\lambda + (1 - \lambda)E]\Pi.$$

Since the initiative effect might dominate the control effect for high levels of concentration, the relationship between ownership concentration and equity value can be nonmonotonic.

PROPOSITION 2. Equity value $W(\alpha)$ is concave in α and maximized when a fraction α_2^* is allocated to a large shareholder and the remaining $(1 - \alpha_2^*)$ to dispersed small shareholders, where $\alpha_2^* = \min\{1; 1/\Pi b(1 - \lambda^2)\}$.

Proof of Proposition 2. See Appendix.

We obtain the following comparative statics and comment on them in subsection II.C.

COROLLARY 2. α_2^* is decreasing in Π and b. $E(\alpha_2^*) = 1/2$ for $\alpha_2^* < 1$.

In our model the commitment to leave some effective control to the management promotes managerial incentives. This could, moreover, have an indirect effect on the incentives of third parties such as employees [Habib 1995], suppliers, customers, other investors, or competitors [Burkart, Gromb, and Panunzi 1995a].

II.C. Empirical Implications

Our main contribution is to posit the existence of the initiative effect. Again, initiative ought to be interpreted as any investment by the insiders that is noncontractible and specific to the firm. Anecdotal evidence apart, it seems difficult to observe directly whether the initiative effect indeed exists. Instead indirect evidence may be obtained by testing its implications for the relationship between outside ownership concentration and measures of firm value. In the following paragraphs we first clarify how an empirical rejection or confirmation of Propositions 1 and 2 should be interpreted and to what extent such tests would separate our theory from others. We then discuss the existing empirical evidence.

Proposition 1 postulates an interior solution to the maximization of the net equity value. While a rejection of Proposition 1 would not exclude that monitoring affects managerial initiative adversely,[12] it would refute its empirical relevance. Insofar as the net equity value is an important determinant of existing ownership structures, the fact that blocks of limited size are the pervasive form of outside equity ownership is in accordance with our theory. Proposition 1 not being rejected, however, can hardly be considered strong support for our theory. Indeed, other theories also postulate a cost of outside ownership concentration and are, hence, consistent with an interior solution. One might get some mileage out of testing Proposition 1 under circumstances in which other theories are likely to predict a corner solution. For instance, the cost of underdiversification is likely to be smaller for institutional than for individual investors.

Corollary 1's empirical implications have to be qualified in the same way. While they also hold for other theories of the costs of ownership concentration, their rejection would refute our theory. For instance, Corollary 1 predicts that lower monitoring costs lead to more monitoring and a lower outside ownership concentration. Factors that facilitate monitoring include the degree of mandatory information disclosure (in particular to nonexecutive directors), and more generally the extent of outside investor rights granted by the legal system and the ease with which they can be enforced. Hence, the extent of outside ownership concentration may be a response to the quality of the legal environment. This view is supported by Shleifer and Vishny [1997] and La Porta et al. [1996].

Proposition 2 posits that, for some parameter constellations, the initiative effect can dominate the control effect. In contrast, the firm's stock price does not reflect private costs incurred either by insiders, such as the loss of private benefits [Pagano and Röell 1995], or by outside monitors such as underdiversification costs. Consequently, theories based on private costs cannot account for a positive stock price reaction to a reduction in outside ownership concentration. Thus, such positive price reactions, if observed,

12. Corner solutions can obtain absent Assumption 2.

would refute these theories but provide strong support for the initiative effect.[13] In an equity carve-out, the parent company floats part of a previously fully owned subsidiary.[14] Within our theory the documented abnormal stock return of parent companies reflects the increase in the subsidiaries' value.

A direct empirical test of our theory would be difficult to devise. On the one hand, the propositions are comparative-static results for a given firm. Moreover, they are derived under the ceteris paribus assumption. In theory, the proposed relationships may fail to hold if a shift in the ownership concentration is offset by changes in other control mechanisms such as managerial compensation (see Demsetz and Lehn [1985] and our Proposition 3, zones 1–2). Hence, event studies controlling for the use of alternative disciplining devices would be most appropriate. On the other hand, if one assumes idiosyncratic deviations from net equity value maximization, a cross-sectional analysis may be granted. Given these caveats, the large empirical literature examining the relationship between firm value and ownership concentration provides only indirect tests of our theoretical results.[15]

Morck, Shleifer, and Vishny's [1988] cross-sectional study documents an S-shaped relationship between board ownership and firm performance (measured either by Tobin's Q or accounting rate of return): increasing in the 0 to 5 percent range, decreasing between 5 and 25 percent and increasing again beyond 25 percent, though at a slower rate. The same relationship is found when examining the ownership by executive and outside directors separately. Wruck's [1989] events study of firms experiencing a change in ownership concentration confirms these findings. The decreasing relationship in the 5 to 25 percent range is consistent with the initiative effect dominating the control effect. This interpretation would also predict a negative relationship for ownership by outside directors beyond 25 percent. Such large blockholders, however, cannot be considered outsiders as they are usually directly involved in the running of the company. The positive relationship beyond 25 percent is evidence of an alignment effect but not a rejection of our theory. Note that other, though fewer,

13. Theories postulating a trade-off between takeover premium and takeover probability (e.g., Burkart [1995]) are also consistent with such a nonmonotonic relationship.

14. For a sample of equity carve-out announcements by NYSE and AMEX firms, Schipper and Smith [1986] document an average positive return to the stock of the parent firm of about 2 percent.

15. See Servaes and Zenner's [1994] survey.

studies find little or no relationship between firm value and ownership concentration when controlling for alternative disciplining mechanisms [Agrawal and Knoeber 1996].

III. Robustness

We now analyze the impact of monetary incentives and the stability of the optimal ownership structure to retrading and show that our analysis is robust to both.

III.A. Monetary Incentives

Monetary incentives and monitoring are alternative devices to mitigate the agency problem. We show that the former do not generally make the latter redundant; i.e., both can coexist in the optimal arrangement. For the sake of tractability we set $\Pi = 1$ and characterize the optimal arrangement for all admissible values of b and λ. The manager's effort and private benefits being noncontractible, his wage depends only on security benefits and takes two values, $w(\Pi)$ and $w(0)$. Due to the manager's limited liability, setting $w(0) = 0$ is optimal. With no ambiguity we use the notation w for $w(\Pi)$.

PROPOSITION 3. Monetary incentives and monitoring can coexist in the optimal arrangement. More precisely, for $\Pi = 1$, there exist thresholds $0 < b_1(\lambda) < b_2(\lambda) \leq b_3(\lambda)$ such that the monetary incentives w^* and outside ownership concentration α_1^* maximizing the net equity value are as follows.

- Zone 1: if $0 < b \leq b_1$, $w^* = (1 - \lambda b)/2 > b$, and α_1^* is indeterminate;
- Zone 2: if $b_1 \leq b \leq b_2$, $w^* = b$, and α_1^* is indeterminate;
- Zone 3: if $b_2 \leq b < b_3$,

$$w^* = b - \frac{(1+\lambda)b[1-(1-\lambda)^2(1-b)^2] - \lambda(1-b)}{2\lambda + (1+\lambda)(1-\lambda)^2(1-b)b} < b,$$

and $\alpha_1^* = \dfrac{1-b}{1-w^*}$;

- Zone 4: if $b_3 \leq b \leq 1$, $w^* = 0$, and $\alpha_1^* =$

$$\frac{1}{1/(1-\lambda) + b(1-\lambda^2)}.$$

Moreover, $b_1(\lambda)$ and $b_2(\lambda)$ are strictly decreasing and $b_3(\lambda)$ strictly increasing in λ, and there exists a threshold λ_0 such that $b_2(\lambda) = b_3(\lambda)$ (i.e., Zone 3 is empty) if and only if $\lambda \leq \lambda_0$.

Proof of Proposition 3. See Appendix.

The manager's wage disciplines him along two dimensions, effort choice and project choice. First, the wage increases his expected payoff and induces him to exert more effort. Second, if $w \geq b$, the manager picks the shareholders' preferred project. For low values of b, aligning the manager's interests can be achieved at low cost, and it will be optimal to set $w \geq b$. In this case, there is no role for monitoring, and the ownership structure is irrelevant. If $w = b$, the manager's expected gain if effort is successful is $w + \lambda b = (1 + \lambda)b$. For b sufficiently small (Zone 1), private benefits do not provide sufficient incentives to exert the optimal effort level. They have to be supplemented with an extra wage; i.e., $w > b$. For higher values of b (Zone 2), incentives for effort are high enough, and it is sufficient to set $w = b$.

If b is large enough, aligning the manager's interests is too costly, and monitoring is useful. However, monitoring reduces incentives to exert effort. As a result, a positive wage is still useful even below b (Zone 3). Note that in this region monitoring and monetary incentives serve different purposes: monitoring is a control device, while monetary incentives induce higher effort.[16] When the manager's private benefits are large (Zone 4), they suffice to induce effort despite monitoring, and monetary incentives are superfluous. Moreover, as interests become more congruent (λ increases), aligning them perfectly with monetary incentives becomes less attractive, and Zones 1 and 2 shrink.

Due to the binary payoff function, offering the manager a wage is equivalent to giving him an equity stake; i.e., the wage can be interpreted as a fraction w/Π of equity.[17] Hence, the robustness result extends to inside equity; i.e., monitoring can remain a valuable governance mechanism when one allows managerial equity ownership.[18]

III.B. Retrading

Another important question is whether the optimal ownership structure is robust to retrading. Since the value of the firm

16. This dichotomy is due to the model's simplicity and would disappear if, e.g., b were stochastic.

17. In a more general model this equivalence breaks down as nonlinear wage contracts arise.

18. Tackling the agency problem with managerial ownership is subject to further constraints. Either the entrepreneur's limited wealth (which is often the reason for outside finance) prevents a sufficient alignment of interests, or managers with substantial stakes use their influence to entrench themselves [Stulz 1988].

is uniquely determined by the block's size, trading among small shareholders is inconsequential. Hence, only the block's stability needs to be examined. Suppose that once the manager has exerted his effort, the large shareholder can trade prior to monitoring.[19] This sequence of moves implies that there are gains from changing the ownership structure. For a given managerial effort, increasing monitoring improves the likelihood that the shareholders' preferred project is undertaken. Nevertheless, the optimal ownership structure is robust, granted that the trade size and the identity of the traders are publicly observed.[20]

PROPOSITION 4. The large shareholder has no incentive to alter her stake if trading is not anonymous.

Proof of Proposition 4. See Appendix.

Once the manager's effort is sunk, the net equity value is monotonically increasing in monitoring. Since all investors are fully informed, the large shareholder cannot make a profit on traded shares. Indeed, a sale reduces security benefits, and rational investors offer a price that fully reflects the value decrease. Consequently, the large shareholder incurs the loss in the initial block's value and thus refrains from splitting it. A purchase by the large shareholder increases share value. Nonetheless, this gain from trade will not materialize due to the free-rider behavior of dispersed shareholders. They retain their shares unless the price matches the posttrade share value [Grossman and Hart 1980]. Consequently, the bid price does not compensate the blockholder ex ante for the increased monitoring cost that she will incur ex post due to her enlarged stake. Again, she will not trade.

IV. GOING PUBLIC

This section analyzes the choice of outside ownership concentration by an initial owner who remains the manager. At date 0 the entrepreneur retains a fixed fraction ω of shares and sells the rest to outside investors.[21] A fraction $\alpha \leq (1 - \omega)$ is sold as a block,

19. This sequence of events is consistent with our simultaneous move model as we do not assume that effort e is observed. A sequential move game with unobserved moves is equivalent to a simultaneous move game.

20. See also Admati, Pfleiderer, and Zechner [1994] and Pagano and Röell [1995].

21. The optimal ω is not derived. In our framework this would amount to optimizing monetary incentives. Since the entrepreneur would always prefer to retain the entire firm, a meaningful analysis of ω would require more ingredients such as the entrepreneur's wealth constraint and investment cost. In such a setting, ω would be determined by the investors' participation constraint.

and $(1 - \omega - \alpha)$ is dispersed. Despite the entrepreneur's stake, we maintain the assumption that outside shareholders can implement their preferred project.[22] For simplicity, we assume that $\lambda = 0$, i.e., full conflict of interests between the entrepreneur and outsiders. In this case, private benefits can be thought of as being derived purely from diverting corporate assets. If $b < \omega\Pi$, there is no conflict of interest, and the outside ownership structure is irrelevant. Instead, we assume that the entrepreneur's equity stake is insufficient to solve the project choice problem; i.e., $\omega\Pi < b$.

At date 1 the entrepreneur chooses e to maximize

$$(1 - e) \cdot 0 + e \cdot [E\omega\Pi + (1 - E)b] - e^2/2.$$

The FOC gives

$$e = \min \{b[1 - E + E \cdot \omega\Pi/b];\ 1\}.$$

At date 0 the entrepreneur chooses α to maximize[23]

$$U = e \cdot [E\Pi + (1 - E)b] - E^2/2 - e^2/2.$$

Taking the derivative with respect to α yields

$$\frac{\partial U}{\partial \alpha} = \frac{\partial E}{\partial \alpha} \cdot [e(\Pi - b) - E] + \frac{\partial e}{\partial \alpha} \cdot [E\Pi + (1 - E)b - e]$$
$$= \frac{\partial E}{\partial \alpha} \cdot [e(\Pi - b) - E] + \frac{\partial e}{\partial \alpha} \cdot E(1 - \omega)\Pi.$$

Compared with equation (1), both control and initiative effects have additional terms. The positive *control effect* is reduced by the new term $-eb$. It represents the cost imposed by monitoring on the entrepreneur in terms of reduced private gains. Note that, for $b > \Pi$, the first term is negative irrespective of the monitoring level. Indeed, private gains are efficient so that monitoring is always inefficient. Furthermore, the first term can be negative for $b < \Pi$ if E is large enough. Indeed, the outside block-holder does not internalize the effect of monitoring on private benefits, and thus might incur a marginal monitoring cost larger than the marginal inefficiency it prevents (even if private gains are inefficient). Like the *initiative effect* this *private gains destruction effect* constitutes an instance of overmonitoring. Note that in the

22. Outside investors might hold a majority of votes. Alternatively, the entrepreneur might have a duty to act in all shareholders' interests. When monitoring is unsuccessful, a breach of duty cannot be proved and the entrepreneur can choose his preferred project.

23. U is also the objective function of an initial owner who does *not* remain the manager if the market for managers is competitive; i.e., if the managers pay for their private benefits.

initiative effect monitoring is inefficient from an ex ante viewpoint but efficient ex post. Instead, in the private gains destruction effect, monitoring is inefficient ex post.

The second term is still negative though modified by $-E\omega\Pi$; i.e., the *initiative effect* is reduced unless $\omega = 0$. Indeed, the cost of effort is set equal to the entrepreneur's marginal gain from effort but, once equity is sold, the entrepreneur does not internalize $E(1 - \omega)\Pi$. Clearly, the entrepreneur's utility need not be monotonic in outside ownership concentration.

PROPOSITION 5. Given ω, the entrepreneur's utility $U(\alpha)$ is concave in α and maximized when a fraction α_3^* is allocated to a large shareholder and $(1 - \alpha_3^* - \omega)$ to dispersed shareholders, where

- $\alpha_3^* = 0$ if $b \geq \Pi$;
- $0 < \alpha_3^* = \dfrac{1 - b/\Pi}{1 + (b - \omega\Pi)(1 - \omega)\Pi} < 1 - \omega$ if $\omega\Pi < b < \Pi$;
- and α_3^* is irrelevant if $b \leq \omega\Pi$.

Proof of Proposition 5. See Appendix.

If $b > \Pi$, private gains are efficient for the entrepreneur even from an ex ante perspective. In addition to the initiative effect, monitoring would destroy private gains and involve a monitoring cost. It is thus optimal to disperse ownership maximally. If $b < \Pi$, private benefits are inefficient. As the entrepreneur internalizes this through the issue price, he would be better off committing not to consume them. If $\omega\Pi \geq b$, the entrepreneur's retained stake is large enough to achieve such a commitment. If $\omega\Pi < b$, outside monitoring is necessary. Not any level of monitoring is efficient, however, due to the initiative effect and the private gains destruction effect. In particular, for high levels of monitoring, the marginal commitment gains may not be worth the marginal monitoring cost. As a result, selling all $(1 - \omega)$ shares as a block is not optimal.[24] Furthermore, the following ranking obtains.[25]

PROPOSITION 6. For all values of ω, $\alpha_3^*(\omega) \leq \alpha_1^*(\omega) \leq \alpha_2^*(\omega)$.

Proof of Proposition 6. See Appendix.

Due to the trade-off between control and initiative, the equity value need not be maximized under full concentration of out-

24. The result that $\alpha_3^* < 1 - \omega$ holds for any $\lambda \in [0,1]$.
25. This ranking holds for all $\lambda \in [0,1]$.

side equity. Net equity value takes direct monitoring costs into account and so is maximized for a lower concentration. From the entrepreneur's point of view, monitoring has an additional cost: it destroys private benefits. Hence, the entrepreneur's utility is maximized at an even lower concentration level, i.e., below the one that maximizes the amount of capital which can be raised by selling the (exogenous) fraction of shares $(1 - \omega)$ to outside investors.

Proposition 6 may also provide a relationship between the competitiveness of the managerial labor market and ownership concentration. Indeed, U can be interpreted as the objective function of an initial owner who does *not* remain manager provided that the managerial labor market is competitive; i.e., managers have to pay for their private benefits. When the managerial labor market is not very competitive, the optimal ownership concentration is closer to α_1^*. When the market is more competitive, the optimal concentration is closer to α_3^*, which is smaller. Moreover, as we now show, different comparative-static results with respect to Π obtain.

COROLLARY 3. For $\omega\Pi < b < \Pi$, α_3^* is increasing in ω and Π and decreasing in b.

A lower inefficiency of private gains, due to a higher b or a lower Π, reduces the need for monitoring, hence for concentrated outside equity. Maybe more surprisingly, the optimal outside ownership concentration increases as inside ownership becomes larger. Indeed, as ω increases, the effort choice problem is alleviated, and the initiative effect is reduced while the project choice problem remains unchanged. As a result, monitoring will be more often useful because its impact on initiative is reduced. Our theory is consistent with a positive correlation between inside and outside equity at low levels of concentration, and possibly an inverse relationship at high levels. Hence, the optimal ownership structure should consist of dispersed equity and either one large or two medium size blocks.[26]

26. See Zwiebel [1995]. However, note that the positive relationship between α_3 and ω is largely driven by an asymmetry in the model: while the effort choice problem is continuous ($e \in [0,1]$), the project choice problem is discrete and thus is not affected by ω below b/Π. Hence, our theory is consistent with but does not strongly predict the positive relation.

V. Contingent Control

V.A. Contingent Effective Control

Optimal contracts may involve a state contingent allocation of control [Aghion and Bolton 1992]. Debt contracts have this feature: control shifts to the creditors if, but only if, default or a violation of covenants occurs. However, control rights protect investors against extreme managerial moral hazard. Hence, they might be unwilling to renounce all control rights in any state of the world. For instance, even though the firm has met all its current obligations (e.g., interest payments), creditors might want to intervene in order to prevent future losses. Furthermore, allocating control to different parties depending on contingencies requires these to be verifiable. We show that voting equity implements a state contingent allocation of control that can circumvent these problems. The crucial point is that equity leads to a state contingent allocation of *effective control,* as opposed to *control rights*. Also, the distribution of effective control can be contingent on states of the world that are observable but not verifiable. Moreover, the set of contingencies in which outside shareholders exercise effective control (as well as the degree to which they exercise it) is determined by the ownership concentration.

To explore these ideas, we modify our basic model as follows. At date 1 the manager chooses his efforts e. For simplicity, monitoring is costless; i.e., $E = 1$. Hence, manager and shareholders are always equally well informed. At this time the security benefits that the shareholders' preferred project yields are a random variable $\tilde{\Pi}$ which is uniformly distributed on [0,1]. If the manager can identify the payoffs from the N projects at date 2, the realization of $\tilde{\Pi}$ is known to him and the shareholders. In contrast to the basic model, the manager is in charge of selecting a project. After he has made his decision, each shareholder has at a fixed cost c the opportunity to intervene and switch to another project.[27] The intervention cost c is nonverifiable and borne privately by the shareholder who challenges the manager's project choice. In addition, intervention is also costly for the manager. When his choice is reversed, he incurs a loss l.

Intervention by the shareholders is meant to capture various

27. In the presence of posttakeover moral hazard between bidder and minority shareholders, takeovers involve an endogenous cost that increases with the amount of shares acquired in the tender offer [Burkart, Gromb, and Panunzi 1995c]. Thus, the fixed cost c is a simplifying assumption.

possible actions, like boardroom fights, proxy contests, or takeovers. Similarly, the manager's loss l can be interpreted as a loss in reputation and prestige, reduced career prospects, or a dismissal. Finally, $E = 1$ is a simplification allowing us to separate the effects of informational asymmetries on delegation from those of intervention costs.

PROPOSITION 7. Equity ownership structure implements a state contingent allocation of effective control. The set of states in which shareholders have effective control increases with the ownership concentration.

Proof of Proposition 7. Due to the cost c, only the large shareholder considers intervening. She reverses the manager's decision if and only if her net profit from doing so, $\alpha\Pi - c$, outweighs the status quo payoff, 0 that is if $\Pi \geq \overline{\Pi} = c/\alpha$. In these states the manager chooses the shareholders' preferred project to avoid intervention and the associated loss l. Thus, when $\Pi \geq \overline{\Pi}$, the shareholders' preferred project is implemented; i.e., shareholders have effective control. In all other states the intervention threat is not credible, and the manager has effective control. Finally, the threshold $\overline{\Pi}$ is decreasing in α.

QED

The state contingent control feature of equity is based on an intervention threat, rather than actual intervention. Since some forms of intervention, e.g., takeovers, involve a change of ownership, this distinction is relevant. In particular, effective control by shareholders does not involve a transfer of control rights. Instead, the *existing* ownership structure gives incumbent shareholders effective control in some states of the world.

Due to the monotonic relationship between $\overline{\Pi}$ and α, the set of states with effective shareholder control is uniquely determined by the ownership concentration. As in Section II the ownership structure involves a trade-off between control and initiative. The manager maximizes

$$e \cdot \left[\lambda b + \Pr[\Pi \leq \overline{\Pi}](1 - \lambda)b\right] - e^2/2.$$

The FOC gives

$$e = b \cdot [\lambda + (1 - \lambda)\overline{\Pi}].$$

The equity value[28] is given by

28. Net equity value equals equity value because intervention does not occur in equilibrium.

$$V = e \cdot \left[\lambda\int_0^1 \Pi d\Pi + (1 - \lambda)\int_{\overline{\Pi}}^1 \Pi d\Pi\right].$$

PROPOSITION 8. Equity value $V(\alpha)$ is concave in α and maximized when a fraction α_1^* is allocated to a large shareholder and the remaining $(1 - \alpha_1^*)$ to dispersed small shareholders, where $\alpha_1^* = \min\{c[\lambda + \sqrt{\lambda^2 + 3(1 - \lambda)}]; 1\}$. Outside shareholders have effective control if and only if $\Pi \geq \overline{\Pi}^* = c/\alpha_1^*$.

Proof of Proposition 8. See Appendix.

When shareholders frequently threaten to overrule the manager, the latter will show little initiative. Hence, shareholders may benefit from committing to leave in some states the project choice to the manager's discretion. The threshold $\overline{\Pi}^*$ defines the optimal set of states with managerial effective control and can be implemented through an appropriate ownership concentration. Obviously, the optimal block size is increasing in the intervention cost. For large values of c a fully concentrated ownership structures might be required, and for $\overline{\Pi}^* < c$ even this leaves the manager with too much effective control. Proposition 8 can also be interpreted in terms of the intervention cost as the choice variable.

COROLLARY 4. Setting $c = 0$ does not maximize the equity value.

Corollary 4 follows directly from the fact that $\overline{\Pi}^* > 0$. It has several implications. For instance, the composition of the Board of Directors can affect the ease with which the manager can be overruled. Corollary 4 suggests that some collusion between management and Board may be optimal. A larger intervention cost increases the manager's effective control, and the resulting increase in initiative might outweigh the loss of control. Similarly, takeover defenses and other managerial entrenchment devices may prove beneficial ex ante even if inefficient ex post.

V.B. An Application to Dividends

The conflict between manager and shareholders over the project choice can be reinterpreted as one over the use of the free cash flow. Jensen [1986] argues that managers tend to reinvest the firm's cash flows in new projects rather than pay them out as dividends, even if these projects have negative net present values. The model of this section provides a partial explanation for why shareholders do not exercise their control rights to force a dividend payout. Since intervention is costly, management retains some effective control. The dividend policy reflects the allocation of effective control inside the firm and is determined by the cost of intervention and ownership concentration. More precisely, suppose that Π is the amount of cash flow available and that the management decides which fraction to pay out and which fraction to reinvest in new projects. Assume further that the management wants to reinvest even in negative NPV projects (due to empire-building ambitions). Thus, dividends reduce the amount of corporate resources that the management can divert at the expense of the shareholders. When announcing the dividend policy D, the management takes into account that the block-holder will intervene and force the complete payout of Π, if $\alpha\Pi - c \geq \alpha D$. In equilibrium, the manager will thus set dividends at the lowest value that avoids intervention; i.e., $D = \Pi - c/\alpha$.

It is easy to see that dividends are increasing in Π and α and decreasing in c. As the block size increases, intervention is more easily triggered, thus reducing the manager's ability to divert resources. The amount of dividends is decreasing in the shareholder's cost of intervention. A lower cost of intervention makes the threat of being overruled more relevant for the manager, obliging him to consume less private benefits.[29] Moreover, a higher level of profits also forces the manager to pay out higher dividends, in order to avoid intervention.[30]

V.C. *Monitoring by a Large Debtholder*

So far, the analysis has dealt exclusively with monitoring by large shareholders. In practice, however, monitoring is also done by banks (debt-holders). Our theory naturally extends to debtholders. Moreover, while the framework is too simplistic for a comprehensive comparison between debt and equity, we can nevertheless point out some differences. Beforehand, it is worth stressing that the trade-off between control and initiative is bound to materialize with any corporate security that has some control rights. However, the extent to which investors monitor and intervene as well as the impact on managerial initiative vary across securities.

29. A low c could be interpreted as a high level of shareholders' legal protection. It is thus tempting to conclude that we should observe higher dividends in countries where shareholders are better protected. However, this would overlook the endogeneity of α. In our model, c actually has no impact on the equilibrium level of dividends.

30. See Acemoglu [1995] and Myers [1996] for models in the same spirit as ours but more specifically designed to address payout policies.

Compare an entirely debt-financed firm with an all-equity firm which are otherwise identical. While voting equity retains the control rights in all states of the world, debt has control rights only in some states, typically when the borrower fails to make the scheduled repayment. Debt allows investor intervention as well as the incentives to monitor to be targeted to a subset of states. In contrast, equity spreads monitoring and intervention by shareholders more evenly across all states. Within our theory, debt and equity will thus differ in their *initiative effect* and *private gains destruction effect.* In particular, the higher precision of investor involvement under debt may in some cases render outcomes feasible that could not be obtained with equity. The following two examples illustrate this point.

First, when intervention and monitoring costs are very low, intervention by equity has an equally high probability in all states. In contrast, debt implements quite different levels of intervention across states. In those states where debt has control rights, intervention by debt is highly likely, while in all other states debt is prevented from intervening. In this respect, debt is like equity where the intervention cost is very low in some states and infinite in others. In situations where managerial private benefits are largest in some states, debt is better suited to promote managerial initiative than equity.

Second, monitoring by a debt-holder is useless in those states where she does not have control rights. Hence, if the monitoring decision is made after the state is revealed, debt-holders will incur monitoring costs in fewer states than equity. Debt financing might thus be chosen over equity by the entrepreneur so as to reduce the private gains destruction effect.

Although debt is superior to equity in both examples, this ranking does not generally hold within our theory. As we argued earlier, outside investors may be reluctant to give up control rights in any state of the world.

VI. Direct versus Performance-Based Evaluation

In this section we derive costs and benefits of ownership concentration in a dynamic setting adapted from Crémer [1995]. Our theory translates into a trade-off between inducing effort through a performance-based reward scheme and directly assessing the manager's quality.

VI.A. The Model

Consider a firm in which a fraction α of the shares is held by a single investor, while $(1 - \alpha)$ are dispersed among small shareholders. All shareholders are risk neutral and have perfectly congruent interests.

At date 0 they hire a risk-neutral manager to run the firm. The manager receives private benefits $b < 1$ only if he is retained at date 2. The manager can be good ($\theta = \theta_G$) or bad ($\theta = \theta_B$). The prior probability that $\theta = \theta_G$ is λ. As θ is unknown even to the manager himself, it refers to his suitability for the job. The manager chooses a nonverifiable effort $e \in [0,1]$ at a cost $e^2/2$. Simultaneously, each shareholder can exert a nonverifiable monitoring effort $E \in [0,1]$ at a cost $E^2/2$. It enables her to learn the manager's type θ with probability E.

At date 1 short-term security benefits are realized which can take two values, $\Pi_1 > 0$ with probability $p(\theta,e)$ or 0 otherwise. We assume that high profits are a good signal about the manager's quality.

ASSUMPTION 3. $p(\theta_G,e) = 1$ and $p(\theta_B,e) = e$.

At date 2 the shareholders decide whether to retain the incumbent manager. Long-term profits depend only on the manager's type and are $\delta\Pi_2 > 0$ if $\theta = \theta_G$ and 0 if $\theta = \theta_B$. (All profits are expressed in date 1 terms, δ being the discount rate.) Alternatively, they can fire him and employ another manager of unknown quality. The probability of hiring a good manager is again λ, and the expected long-term profits under a new manager are thus $\lambda\delta\Pi_2$.

VI.B. Competing Evaluation Systems

Absent further information, the shareholders' decision whether to retain the manager will rely on an evaluation based on the profits generated at date 1.[31] The manager is retained if

31. First, offering severance payments for bad managers revealing themselves is not feasible here as they ignore their type. Even if they did not, a severance payment might be too costly because they should compensate the manager for the loss of private gains but also for the reduced career prospects (including those outside the firm). Furthermore, even if severance payments are worthwhile, monitoring could reduce their level. Second, the shareholders may be better off committing to fire the manager with a positive probability in case of good performance. Indeed, this would discourage effort and thus make performance more informative about the manager's quality. However, such a contract is not renegotiation-proof as following a good performance, the manager and the shareholders would agree to continue their relationship.

$\Pi_1 > 0$ and fired otherwise. As performance is an imperfect signal of θ, a bad manager may be retained. Shareholders can improve on the *performance-based evaluation* by trying to *evaluate directly* the manager's quality. Due to free riding by small shareholders, only the block-holder will incur the monitoring cost. Given E, the manager maximizes

$$b[\lambda + (1 - \lambda)e] - b(1 - \lambda)eE - e^2/2.$$

The first term corresponds to performance-based evaluation: good and bad managers are maintained if and only if they produce Π_1. The second term captures the impact of monitoring: a bad manager can be replaced despite a good performance. The FOC yields

$$e = b(1 - \lambda)(1 - E).$$

Performance-based evaluation gives the manager the incentive to produce a high short-term profit. However, it prevails only when direct evaluation fails, i.e., with probability $(1 - E)$. Hence, close monitoring weakens managerial incentives. Given e, the block-holder maximizes

$$\alpha[\lambda(\Pi_1 + \delta\Pi_2) + (1 - \lambda)e\Pi_1 + (1 - \lambda)(1 - e)\lambda\delta\Pi_2 + (1 - \lambda)eE\lambda\delta\Pi_2] - E^2/2.$$

The first three terms correspond to performance-based evaluation, and the fourth to the alteration caused by direct evaluation. The FOC yields

$$E = \alpha(1 - \lambda)\lambda\delta\Pi_2 e.$$

Direct evaluation increases with the block size and the importance of long-term profits. Furthermore, monitoring is increasing in managerial effort. Indeed, an increase in the effort makes short-term profits less informative about the manager's quality, and direct evaluation becomes more useful. Solving for E and e in the FOCs yields

$$E(\alpha) = \frac{\alpha\lambda(1 - \lambda)^2 b\delta\Pi_2}{1 + \alpha\lambda(1 - \lambda)^2 b\delta\Pi_2} \quad \text{and} \quad e(\alpha) = \frac{b(1 - \lambda)}{1 + \alpha\lambda(1 - \lambda)^2 b\delta\Pi_2}.$$

It is easy to see that $\partial E/\partial\alpha > 0$ and $\partial e/\partial\alpha < 0$. The block-holder's monitoring increases with her block's size. This is beneficial as she puts more emphasis on the long-term value of the firm. However, this reduces the manager's incentives as his short-term performance is less likely to enter the shareholders' evaluation. Due to these conflicting effects, net equity value,

$$V = \lambda(\Pi_1 + \delta\Pi_2) + (1 - \lambda)e\Pi_1 + (1 - \lambda)(1 - e)\lambda\delta\Pi_2 + (1 - \lambda)eE\lambda\delta\Pi_2 - E^2/2,$$

need not be monotonic in outside ownership concentration.

PROPOSITION 9. Net equity value $V(\alpha)$ is concave in α and maximized when a fraction α_1^* is allocated to a large shareholder and the remaining $(1 - \alpha_1^*)$ to dispersed small shareholders, where

- $\alpha_1^* = 0$ if $\Pi_1 > 2\lambda\delta\Pi_2$;
- $\alpha_1^* = 0$ if $\Pi_1 < \lambda\delta\Pi_2[1 - (1 - \lambda)^2 b\Pi_1]$;
- and $\alpha_1^* = \dfrac{2\lambda\delta\Pi_2 - \Pi_1}{\lambda\delta\Pi_2[1 + (1 - \lambda)^2 b\Pi_1)]}$ otherwise.

Proof of Proposition 9. See Appendix.

We obtain the following comparative-static results.

COROLLARY 5. α_1^* is increasing in $\delta\Pi_2$ and decreasing in Π_1.

On the one hand, the value of assessing the quality of the manager correctly increases as long-term profits become more important. A more concentrated ownership leads to more monitoring, reducing the likelihood of retaining a bad manager. On the other hand, the optimal ownership is more dispersed when short-term profits are more important. Managerial effort needs to be encouraged by giving the signal Π_1 more weight in the retention decision.

VI.C. Implications

The model has several implications. First, it predicts more divestitures and higher managerial turnover following good performance when ownership is concentrated. Second, we expect ownership concentration to be increasing in the wedge between long-term and short-term returns. Start-up firms, which usually have low current income relative to their future earning capacities fall into this category. Outside investors such as venture capitalists do indeed hold considerable stakes in such companies, sitting on boards and taking part in the decision-making process. As regards interindustry comparisons, our model predicts high concentration in growth industries and more dispersed ownership in mature or declining industries (with a low Tobin's *Q*). Nevertheless, a large outside investor may be required when drastic restructuring or downsizing are needed. In such instances, the gains from choosing the correct long-term option, e.g., exit, may be particularly large. For a sample of British firms, Franks, Mayer, and Renneboog [1996] document that ownership concentration rises during periods of financial difficulty. Finally, relative short-termism should prevail when ownership is dispersed for exogenous reasons. Several authors (e.g., Roe [1990]) have argued that the legal environment in the United States discourages the formation of blocks. To the extent that the legal system is exogenous, our theory is consistent with the popular view that American firms tend to put more emphasis on short-term objectives than their German counterparts which are subject to tighter internal control.

VII. Concluding Remarks

We argue that managerial discretion comes with costs but also with benefits. Indeed, tight control by outside shareholders may be ex post efficient but constitutes ex ante an expropriation threat that reduces the level of noncontractible investments by managers. The paper's key idea is that a dispersed ownership structure commits shareholders not to exercise excessive control. Consequently, ownership concentration involves a trade-off between control and initiative. Three extensions are explored. First, even though they are residual claimants at the IPO stage, initial owners have a further reason to limit monitoring through dispersed ownership. Indeed, outside investors might overmonitor because they do not internalize private gains. Second, equity is shown to allocate effective control on a state-contingent basis. The set of states in which shareholders have effective control increases with the ownership concentration. Third, we show that monitoring can reduce the effectiveness of incentive schemes based on performance.

In order to focus on the trade-off between control and initiative, some important issues have been left aside. We assumed perfect congruence of interests between large and small shareholders. The potential conflict of interest among shareholders might actually be productive, i.e., lead to higher managerial effort. Indeed, the signaling value of performance is strengthened by the fact that small shareholders do not necessarily trust the information reported by the large shareholder.

While our analysis takes equity financing as given, the insight that control rights as well as the incentives to exercise them matter is relevant for a wider range of issues. For example, Burkart, Gromb, and Panunzi [1995b] derive optimal debt contracts with several creditors and show that the seniority of large creditors emerges.[32] More generally, deriving the optimal capital structure and the ownership structure of different claims is left for future research.

Appendix

Proof of Proposition 1

Replacing e in V by its expression in E as given in the FOC and differentiating w.r.t. E gives $V' = \Pi b(1 - \lambda)^2(1 - 2E) - E$. V is strictly concave and an interior maximum obtains at $E^* = (\Pi b(1 - \lambda)^2)/(1 + 2\Pi b(1 - \lambda)^2)$. Solving for α in $E(\alpha) = E^*$ yields

$$\alpha_1^* = \frac{1}{1/(1 - \lambda) + \Pi b(1 - \lambda^2)}.$$

Proof of Proposition 2

We have $dW/dE = e(1 - \lambda)\Pi + de/dE[\lambda + (1 - \lambda)E]\Pi$. Given that e is linear and strictly decreasing in E, W is quadratic and strictly concave in E. Solving the FOC yields the result. Note that both parameter constellations considered are consistent with Assumption 2 as $1/(\lambda(1 - \lambda)) > 1/(1 - \lambda^2)$.

Proof of Proposition 3

CASE 1: $w \geq b$. Monetary incentives align the manager's interest so that monitoring is useless ($E = 0$ for all α). The optimal ownership structure is indeterminate. The manager maximizes $e(w + \lambda b) - e^2/2$. The FOC gives $e = \min\{w + \lambda b; 1\}$. The net equity value is $V_1(e) = e(\Pi - w) = e(\Pi + \lambda b - e)$, and the FOC gives $e^* = (\Pi + \lambda b)/2$. The constraints $e \leq 1$ and $w \geq b$ imply three subcases.

Case 1.1: if $b < \Pi/(2 + \lambda)$, then constraints are slack; i.e., $w = (\Pi - \lambda b)/2$, $e = (\Pi + \lambda b)/2$ and $V_{1.1}(b) = (\Pi + \lambda b)^2/4$.

32. In Burkart, Gromb, and Panunzi [1995b], information is assumed to increase the continuation payoff so that a large creditor cannot commit to liquidate the firm. The optimal debt design balances the incentive costs of a soft budget constraint against inefficient liquidation.

Case 1.2: if $\Pi/(2 + \lambda) < b < 1/(1 + \lambda)$, then $w = b$, $e = (1 + \lambda)b$, and $V_{1.2}(b) = (1 + \lambda)b(\Pi - b)$.
Case 1.3: if $1/(1 + \lambda) < b$, then $w = b$, $e = 1$, and $V_{1.3}(b) = \Pi - b$.

CASE 2: $w \leq b$. The manager maximizes $e[E(w + \lambda b) + (1 - E)(\lambda w + b)] - e^2/2$, and the FOC gives $e = (\lambda w + b) - E(1 - \lambda)(b - w)$ or

$$w = \frac{e - b + Eb(1 - \lambda)}{\lambda + E(1 - \lambda)} = b - \frac{(1 + \lambda)b - e}{\lambda + E(1 - \lambda)}.$$

The value of the firm is $V_2 = e[\lambda + (1 - \lambda)E](\Pi - w) - E^2/2$. Replacing w yields

$$V_2(e,E) = e\left[\lambda\Pi - e + b + (1 - \lambda)(\Pi - b)E\right] - E^2/2.$$

V_2 is concave in e and E, and the FOCs give

$$\frac{\partial V_2}{\partial E} = e(1 - \lambda)(\Pi - b) - E = 0$$
$$\frac{\partial V_2}{\partial e} = \lambda\Pi - 2e + b + (1 - \lambda)(\Pi - b)E = 0.$$

Solving this system yields

$$e^* = \frac{b + \lambda\Pi}{2 - (1 - \lambda)^2(\Pi - b)^2} \quad \text{and} \quad E^* = (1 - \lambda)(\Pi - b)e^*$$
$$w^* = b + \frac{e^* - (1 + \lambda)b}{\lambda + (1 - \lambda)^2(\Pi - b)e^*}.$$

We need to check the conditions $0 \leq w \leq b$, $e \leq 1$ and $E^* \leq 1$.

LEMMA 1. $e^* \leq 1$ and $E^* \leq 1$ are always satisfied.

Proof.

$$\begin{aligned}1 - e &= 1 - \frac{b + \lambda\Pi}{2 - (1 - \lambda)^2(\Pi - b)^2} \\ &= \frac{2 - (1 - \lambda)^2(\Pi - b)^2 - \lambda(\Pi - b) - (1 + \lambda)b}{2 - (1 - \lambda)^2(\Pi - b)^2} \\ &> \frac{2 - (\Pi - b) - (1 + \lambda)b}{2 - (1 - \lambda)^2(\Pi - b)^2} = \frac{2 - \Pi - \lambda b}{2 - (1 - \lambda)^2(\Pi - \mathrm{b})^2} > 0.\end{aligned}$$

Moreover, $E^* \leq 1$ is also satisfied as $E^* = (1 - \lambda)(\Pi - b)e^*$.

QED

LEMMA 2. The equations $b = \lambda/(\Pi - b)/(1 + \lambda)[1 - \lambda)^2(\Pi - b)^2]$ and $b = \lambda(\Pi - b)/((1 - \lambda)[1 - (1 - \lambda^2)(\Pi - b)\Pi])$ have unique positive solutions denoted b_2^1 and b_2^2. Moreover, (i) $w \leq b$ holds if and only if $b \geq b_2^1$; (ii) $w \geq 0$ holds if and only if $b \leq b_2^2$; (iii) b_2^2 is strictly increasing in λ and goes to Π when λ goes to 1; (iv) $b_2^1 < b_2^2$; (v) $b_2^1 < 1/(1 + \lambda)$.

Proof. In both equations the right-hand side is positive and strictly decreasing in b, while the left-hand side is increasing on [0,1]. Hence they both admit a unique solution on [0,1]. (i) $w \leq b$ holds iff $e^* \leq (1 + \lambda)b$; i.e., iff $\lambda(\Pi - b) \leq (1 + \lambda)b[1 - (1 - \lambda)^2(\Pi - b)^2]$ or

$$b \geq \frac{1}{1+\lambda}\frac{\lambda(\Pi - b)}{[1 - (1 - \lambda)^2(\Pi - b)^2]}.$$

(ii) $w \geq 0$ holds iff $e - b + b(1 - \lambda)E \geq 0$; i.e.,

$$\frac{\lambda(\Pi - b)}{(1 - \lambda)[1 - (1 - \lambda^2)(\Pi - b)\Pi]} \geq b.$$

(iii) b_2^2 is defined by $b(1 - \lambda)[1 - (1 - \lambda^2)(\Pi - b)\Pi] - \lambda(\Pi - b) = 0$. The derivatives of the left-hand side w.r.t. λ and b are

$$\frac{\partial LHS}{\partial \lambda} = \Pi b(\Pi - b)\ [2\lambda(1 - \lambda) + (1 - \lambda^2)] - \Pi$$
$$\leq -\Pi\left[1 - \frac{1}{4}\frac{4}{3}\right] < 0$$
$$\frac{\partial LHS}{\partial b} = 1 - (1 - \lambda)(1 - \lambda^2)(\Pi - 2b)\Pi > 0.$$

(iv) Consequence of (i) and (ii). (v) $b_2^1 < 1/(1 + \lambda) \Leftrightarrow \lambda(\Pi - b)/(1 - (1 - \lambda)^2(\Pi - b)^2) < 1 \Leftrightarrow \lambda(\Pi - b) < 1 - (1 - \lambda)^2(\Pi - b)^2$ which holds, since $(1 - \lambda)^2(\Pi - b)^2 < (1 - \lambda)(\Pi - b)$ and $(\Pi - b) < 1$.
QED

We thus have to distinguish three subcases.

Case 2.1: if $b \leq b_2^1$, then $w = b$. However, it is always better (though not always optimal) to set $w > b$ but arbitrarily close to b so as to economize on the monitoring costs.
Case 2.2: if $b_2^1 \leq b \leq b_2^2$, then the constraints are slack:

$$V_{2.2}(b) = e\left[\lambda\Pi - e + b + (1 - \lambda)^2(\Pi - b)^2\frac{e}{2}\right]$$
$$= \frac{(b + \lambda\Pi)^2}{2[2 - (1 - \lambda)^2(\Pi - b)^2]}.$$

Case 2.3: if $b_2^2 \le b$, then $w = 0$, and we are in the case without monetary incentives. The value of the firm is $V_{2.3}(b) = \lambda b\Pi + (b^2\Pi^2(1-\lambda)^4)/(2[1+2b\Pi(1-\lambda)^2])$.

OPTIMUM. It remains to compare the optimal solutions obtained in cases 1 and 2. First, remark that $V_{1.1}(e) - V_{2.2}(e,E) = e(\Pi - w)(1-\lambda)(1-E) + E^2/2 > 0$. Hence, whenever an interior solution obtains in Case 1, it is also the best of both cases:

$$w^* = \frac{\Pi - \lambda b}{2} \quad \text{if} \quad b \le b_1(\lambda) = \frac{\Pi}{2+\lambda}.$$

LEMMA 3. $V_{1.2}(b) - V_{2.3}(b)$ is strictly decreasing in b on $[\Pi/(2+\lambda),1]$, positive at $\Pi/(2+\lambda)$ and negative at $1/(1+\lambda)$. The threshold $\breve{b} \in (\Pi/(2+\lambda), 1/(1+\lambda))$ defined by $V_{1.2}(\breve{b}) = V_{2.3}(\breve{b})$ is strictly decreasing in λ.

Proof. $g(b) = V_{1.2}(b) - V_{2.3}(b) = (1+\lambda)b(\Pi - b) - \lambda b\Pi - (b^2\Pi^2(1-\lambda)^4)/(2[1+2b\Pi(1-\lambda)^2])$. The third term is negative and decreasing in b. Denote $f(b)$ the sum of the first two terms. We have $f'(b) = \Pi - 2(1+\lambda)b$ which is negative for $b \ge \Pi/(2+\lambda)$ so that $g'(b) < 0$. Moreover, $f(\Pi/(2+\lambda)) = \Pi^2/(2+\lambda)^2 > b^2\Pi^2(1-\lambda^4/2[1+2b\Pi(1-\lambda)^2]$ so that $g(\Pi/(2+\lambda)) > 0$ and $f(1/(1+\lambda)) = -(1-\Pi)/(1+\lambda) < 0$ so that $g(1/(1+\lambda)) < 0$.

QED

LEMMA 4. $V_{1.2}(b) - V_{2.2}(b)$ is decreasing in b on $[\Pi/(2+\lambda),1]$ and positive at $\Pi/(2+\lambda)$.

Proof.

$$\frac{\partial\{V_{1.2}(b) - V_{2.2}(b)\}}{\partial b} = (1+\lambda)(\Pi - 2b) - \frac{2(b+\lambda\Pi)[2-(1-\lambda)^2(\Pi-b)^2] - (b+\lambda\Pi)^2[2(1-\lambda)^2(\Pi-b)]}{2[2-(1-\lambda)^2(\Pi-b)^2]^2}$$

$$= \frac{(1+\lambda)(\Pi-2b)[2-(1-\lambda)^2(\Pi-b)^2]^2}{[2-(1-\lambda)^2(\Pi-b)^2]^2} - \frac{(b+\lambda\Pi)[2-(1-\lambda)^2(\Pi-b)(1+\lambda)\Pi]}{[2-(1-\lambda)^2(\Pi-b)^2]^2}.$$

Since $b > \Pi/(2+\lambda)$, we have

$$\frac{\partial\{V_{1.2}(b) - V_{2.2}(b)\}}{\partial b} < \frac{(1+\lambda)[\lambda\Pi/(2+\lambda)][2-(1-\lambda)^2(\Pi-b)^2]^2}{[2-(1-\lambda)^2(\Pi-b)^2]^2}$$
$$-\frac{(1+\lambda)^2[\Pi/(2+\lambda)][2-(1-\lambda)^2(\Pi-b)(1+\lambda)\Pi]}{[2-(1-\lambda)^2(\Pi-b)^2]^2}$$
$$< -\frac{(1+\lambda)(1-\lambda)\Pi}{(2+\lambda)[2-(1-\lambda)^2(\Pi-b)^2]^2}[2+4\lambda(1-\lambda)(\Pi-b)^2]$$
$$+\frac{(1+\lambda)(1-\lambda)\Pi}{(2+\lambda)[2-(1-\lambda)^2(\Pi-b)^2]^2}[\lambda(1-\lambda)^3(\Pi-b)^4$$
$$+(1+\lambda^2)(\Pi-b)(1+\lambda)\Pi]$$
$$< 0 \text{ as } 2 > (1-\lambda^2)(\Pi-b)(1+\lambda)\Pi \text{ and } 4 > (1-\lambda)^2(\Pi-b)^2.$$

At $V_{1.2}(\Pi/(2+\lambda)) = V_{1.1}(\Pi/(2+\lambda)) > V_{2.2}(\Pi/(2+\lambda))$, since Case 1.1 dominates on $[0,\Pi/(2+\lambda)]$.

QED

LEMMA 5. The threshold $\hat{b}$ defined by $V_{1.2}(\hat{b}) = V_{2.2}(\hat{b})$ is strictly decreasing in λ. We have $\hat{b} > \Pi/(2+\lambda)$. Moreover, there exists a threshold λ_0 such that $\hat{b} = b_2^2$.

Proof. $\hat{b}$ is defined since $V_{1.2}(1) = 0 < V_{2.2}(1)$ and $V_{1.2}(\Pi/(2+\lambda)) > V_{2.2}(\Pi/(2+\lambda))$. $\hat{b} > \Pi/(2+\lambda)$ obtains as a direct consequence. We show that if, for given λ and b we have $V_{1.2}(b) - V_{2.2}(b) < 0$, then $(\partial\{V_{1.2}(b) - V_{2.2}(b)\})/\partial\lambda < 0$.

$$\frac{\partial\{V_{1.2}(b) - V_{2.2}(b)\}}{\partial\lambda} = b(1-b) - \frac{2(b+\lambda)}{4-2(1-\lambda)^2(1-b)^2}$$
$$-\frac{-(b+\lambda)^2 4(1-\lambda)(1-b)^2}{[4-2(1-\lambda)^2(1-b)^2]^2}$$
$$= V_{1.2}(b) - V_{2.3}(b) - \lambda b(1-b)$$
$$-\frac{(b+\lambda)^2}{4-2(1-\lambda)^2(1-b)^2}\left[\frac{2}{b+\lambda} - 1 - \frac{2(1-\lambda)(1-b)^2}{2-(1-\lambda)^2(1-b)^2}\right]$$
$$< -\frac{(b+\lambda)^2}{4-2(1-\lambda)^2(1-b)^2}\left[\frac{2}{b+\lambda} - 1 - \frac{2(1-\lambda)(1-b)^2}{2-(1-\lambda)^2(1-b)^2}\right]$$
$$< -\frac{(b+\lambda)^2}{4-2(1-\lambda)^2(1-b)^2}\left[\frac{2}{b+\lambda} - 1 - \frac{2(1-\lambda)(1-b)}{2-(1-\lambda)^2(1-b)^2}\right].$$

(The last inequality obtains by noting that $(1-b)^2 \leq (1-b)$ as $(1-b) \leq 1$.) Let us show that $A = 2/(b+\lambda) - 1 - (2(1-\lambda)(1-b))/(2-(1-\lambda)^2(1-b)^2)$ is positive. Denote $x = (1-\lambda)$ and $y = (1-b)$. We have

$$A = \frac{x+y}{2-(x+y)} - 2\frac{xy}{2-x^2y^2} = \frac{(x+y)(3-(1-xy)^2)-4xy}{[2-(x+y)][2-x^2y^2]}$$

$$\geq \frac{2(x+y)-4xy}{[2-(x+y)][2-x^2y^2]} = \frac{2x(1-y)+2y(1-x)}{[2-(x+y)][2-x^2y^2]} \geq 0.$$

As a consequence, $\hat{b}$ is strictly decreasing in λ. Since b_2^2 is strictly increasing in λ from 0 to 1, the two intersect at a unique λ_0.

QED

CASE A: $b_2^2 \leq \hat{b}$; i.e., $\lambda \leq \lambda_0$. Define $b_3 = \check{b}$. For $b \in [b_1, b_2^2]$, $V_{1.2}(b) > V_{2.2}(b)$ while for $b \in [b_2^2, b_3]$, $V_{1.2}(b) > V_{2.3}(b)$ and so Case 1.2 dominates on $[b_1, b_3]$. For $b \in [b_3, 1]$, $V_{1.2}(b) < V_{2.3}(b)$, and so Case 2.3 dominates.

CASE B: $b_2^2 \geq \hat{b}$; i.e., $\lambda \geq \lambda_0$. Define $b_2 = \hat{b}$ and $b_3 = b_2^2$. For $b \in [b_1, b_2]$, $V_{1.2}(b) > V_{2.2}(b)$, and Case 1.2 dominates. For $b \in [b_2, b_3]$, $V_{1.2}(b) < V_{2.2}(b)$, and Case 2.2 dominates. For $b \in [b_3, 1]$, $V_{1.2}(b) < V_{2.3}(b)$, and so Case 2.3 dominates.

Proof of Proposition 4

Let $S(E)$ denote the equity value with effort E for a given e. Once e is sunk, $S(E)$ is increasing in E. The block-holder's payoff is $\alpha S(E) - E^2/2$ which is maximized at $E(\alpha)$. Suppose that she sells a fraction Δ. The equity value falls from $S(E(\alpha))$ to $S(E(\alpha - \Delta))$. Hence, the selling price set by rational investors will be $S(E(\alpha - \Delta))$. Suppose instead that she buys Δ. The equity value will increase from $S(E(\alpha))$ to $S(E(\alpha + \Delta))$. Each atomistic shareholder, however, will free ride and retain his shares unless the price matches the posttrading share value $S(E(\alpha + \Delta))$. Hence, the block-holder's return from buying/selling Δ is

$$(\alpha \pm \Delta)S(E(\alpha \pm \Delta)) - E^2(\alpha \pm \Delta)/2 \pm \Delta S(E(\alpha \pm \Delta)),$$

which can be rewritten as

$$\alpha S(E(\alpha \pm \Delta)) - E^2(\alpha \pm \Delta)/2,$$

which, by definition of $E(\alpha)$, is maximized for $\Delta = 0$.

Proof of Proposition 5

Once the ownership structure is set, for a given E, the entrepreneur maximizes $e[E\omega\Pi + (1 - E)b] - e^2/2$. The FOC gives $e = b - (b - \omega\Pi)E$. For a given e, the block-holder maximizes $eE\alpha\Pi - E^2/2$. The FOC gives $E = e\alpha\Pi$. At the ex ante stage the entrepreneur maximizes $V = e[E\Pi + (1 - E)b] - E^2/2 - e^2/2$. The FOC gives $\partial V/\partial E = (\Pi - b)b - (b - \omega\Pi)[\Pi(2 - \omega) - b]E - E$ so that V is maximized at

$$E = \frac{(\Pi - b)b}{1 + (b - \omega\Pi)[\Pi(2 - \omega) - b]},$$

from which we derive the expression of α_3^*. Checking that $\alpha_3^* < 1 - \omega$ amounts to showing that

$$\alpha_3^* = \frac{\Pi - b}{\Pi[1 + (b - \omega\Pi)(1 - \omega)\Pi]} < \frac{\Pi - b}{\Pi} < \frac{\Pi - \omega\Pi}{\Pi} = 1 - \omega.$$

Proof of Proposition 6

It is clear that $\alpha_1^* < \alpha_2^*$ because $V = W - E^2/2$ and $(-E^2/2)$ is decreasing in E. Let us now show that $\alpha_3^* < \alpha_1^*$. The entrepreneur's utility at date 1, denoted X, does not internalize the value of outside equity net of monitoring costs:

$$\begin{aligned} U &= X + (1 - \omega) \cdot W - E^2/2 \\ &= X - \omega E^2/2 + (1 - \omega) \cdot V. \end{aligned}$$

Since X and $(-\omega E^2/2)$ are decreasing in E, the value of E maximizing U is less than that maximizing V. Hence, $\alpha_3^* < \alpha_1^*$.

Proof of Proposition 8

Inserting the manager's FOC into the value of the firm yields

$$V = b[\lambda + (1 - \lambda)\overline{\Pi}]\left[\tfrac{1}{2}(1 - (1 - \lambda)\overline{\Pi}^2)\right]$$

The FOC gives $\partial V/\partial\overline{\Pi} = -(b/2)(1 - \lambda)[3(1 - \lambda)\overline{\Pi}^2 + 2\lambda\overline{\Pi} - 1] = 0$. The SOC gives $\partial^2 V/\partial\overline{\Pi}^2 = -b(1 - \lambda)[3(1 - \lambda)\overline{\Pi} + \lambda] < 0$. Solving the FOC yields

$$\overline{\Pi}^* = \frac{-\lambda + \sqrt{\lambda^2 + 3(1 - \lambda)}}{3(1 - \lambda)} = \frac{1}{\lambda + \sqrt{\lambda^2 + 3(1 - \lambda)}}.$$

$\overline{\Pi}^*$ is decreasing in λ. Indeed, let $f(\lambda) = \lambda + \sqrt{\lambda^2 + 3(1 - \lambda)}$. We have $f'(\lambda) = 1 + (2\lambda - 3)/(2\sqrt{\lambda^2 + 3(1 - \lambda)}) = (\sqrt{\lambda^2 + 3(1 - \lambda)} + \lambda - 3/2)/\sqrt{\lambda^2 + 3(1 - \lambda)}$. The numerator is positive iff $\sqrt{\lambda^2 + 3(1 - \lambda)} > 3/2 - \lambda$ which always holds. Hence $\alpha_1^* = \min\{1, c[\lambda + \sqrt{\lambda^2 + 3(1 - \lambda)}]\}$.

Proof of Proposition 9

$dV/dE = -b(1 - \lambda)^2\Pi_1 + 2\lambda(1 - \lambda)^2(1 - E)b\delta\Pi_2 - E$. Hence, V is concave and reaches its maximum at $E^* = b(1 - \lambda)^2(2\lambda\delta\Pi_2$

$- \Pi_1)/(1 + 2\lambda(1 - \lambda)^2 b\delta\Pi_2)$. The optimal concentration is $\alpha_1^* = (2\lambda\delta\Pi_2 - \Pi_1)/(\lambda\delta\Pi_2[1 + b(1 - \lambda)^2\Pi_1])$. Hence $\alpha_1^* = 0$ if $2\lambda\delta\Pi_2 < \Pi_1$, $\alpha_1^* = 1$ if $\lambda\delta\Pi_2 > \Pi_1/[1 - b(1 - \lambda)^2\Pi_1]$ and $\alpha_1^* = (2\lambda\delta\Pi_2 - \Pi_1)/(\lambda\delta\Pi_2[1 + b(1 - \lambda)^2\Pi_1)])$ otherwise.

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