Delegation of Control Rights, Ownership Concentration, and the Decline of External Finance*

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June 1999

Very Preliminary

Abstract

If ownership and control are separated, leaving the manager with discretion may be of value. This paper discusses the extent to which a firm's ownership structure may serve as a commitment for shareholders not to interfere with the manager's project decisions, thereby reducing the agency cost of debt. As shareholder passivity means granting the manager more freedom, the costs of this commitment are increased managerial on-the-job consumption and shirking. Trading off the costs and benefits of managerial discretion, we derive a unique optimal ownership concentration. The paper also establishes a link between firm growth and ownership structure, implying that firms with concentrated ownership may forego profitable investment opportunities even if there is no credit rationing. Moreover, the paper discusses the extent to which agency problems between shareholders and debtholders can be alleviated by delegating control to debtholders.

*We thank Julian Franks, Martin Hellwig, Christian Laux, and seminar participants at the University of Mannheim for helpful comments. Financial support from Deutsche Forschungsgemeinschaft, Sonderforschungsbereich 504, is gratefully acknowledged.

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1 Introduction

In recent years, a considerable part of the corporate finance literature has been concerned with the role of capital structure in disciplining management.[1] While the focus of earlier articles is mainly on debt (Grossman and Hart 1982; Jensen 1986), Dewatripont and Tirole (1994), in a more recent article, emphasize the dual role of debt and (outside) equity in providing a firm's manager with incentives. In their model, equityholders cannot commit to liquidate the firm if the manager has shirked, thereby weakening incentives ex ante. By contrast, debtholders, on account of their concave payoff function, can commit to such action as liquidation means replacing (risky) assets with cash. In an optimal capital structure, some equity is necessary though to render the debtholder's payoff function sufficiently concave. Thus, it is the co-existence of debt and equity that mitigates inefficiencies arising from managerial discretion.

In this paper, we take the opposite viewpoint and look at the role of managerial discretion in curbing inefficiencies arising from the co-existence of debt and equity. As is well known (Jensen and Meckling 1976; Hellwig 1994), shareholders of a levered firm may engage in excessive risk-taking due to the convex nature of their payoff function. If ownership and control are separated, however, the extent to which this risk-shifting occurs depends on the manager's preferences regarding project choice. If these preferences are not completely aligned with those of the shareholders (which is what we assume), leaving the manager with discretion may reduce the agency cost of debt.[2] Given this situation, shareholders face a time consistency problem. Ex ante, the shareholders would like to commit not to interfere with the manager's project choice. Ex post though, i.e. after the debt is in place, they have a clear incentive to overrule the manager's decision and gamble with the debtholders' money. The main focus of this paper is on the extent to which a firm's ownership structure may serve as a commitment device for the shareholders to keep out of the firm's project decisions, thereby alleviating the agency conflict between shareholders and debtholders.

In our model, leaving the manager with discretion comes with both benefits and costs. In particular, we assume that if shareholders remain passive, the manager diverts part of the project's return, which may be conveniently thought of as on-the-job consumption. Trading off the costs and benefits of managerial discretion, we derive a unique optimal ownership structure. Recently, optimal ownership structures have also been derived by

[1] For surveys, see Harris and Raviv (1991), Allen and Winton (1995), and Shleifer and Vishny (1997).

[2] A similar point is made by Hirshleifer and Thakor (1992). In their model, ownership concentration, which is at the heart of our paper, plays no role though. In the Jensen-Meckling setting, managerial preferences regarding project choice are completely aligned with those of outside shareholders as the manager owns (at least) part of the firm himself.

Stulz (1988), Burkart, Gromb, and Panunzi (1997), and Pagano and Röell (1998). In Stulz's model, the higher the fraction of the firm's equity (and hence votes) controlled by management, the greater the premium potential acquirers must offer to gain control of the firm, but also the lower the probability that a hostile bid occurs. As managerial control of voting rights rises, firm value initially increases, but then falls, implying that there exists an optimal ownership structure where management holds a positive fraction of the firm's equity. More related to our paper is the work by Burkart, Gromb, and Panunzi. To our knowledge, they are the first to show that dispersed share ownership may serve as a commitment for the firm's shareholders to keep out of the firm.[3] Unlike our paper, however, this commitment is not vis-á-vis a third party (e.g. debtholders), but vis-á-vis the manager himself, whose firm-specific investment is positively related to the degree of discretion he enjoys. The cost of managerial discretion in the Burkart, Gromb, and Panunzi model is that the manager's and shareholders' preferences regarding project choice are not perfectly congruent. By contrast, this lack of congruence is exactly what constitutes the *benefit* of managerial discretion in our model. Finally, Pagano and Röell take the viewpoint of an initial owner-manager who wants to go public but remain manager of the firm. The crux is that the owner and manager-to-be extracts private benefits of control, which is partially inefficient as it involves a deadweight loss. From the shareholders' perspective though, the inefficiency is greater than from the perspective of the initial owner since benefits are purely private. Not taking this externality into account, shareholders monitor too much. To limit this inefficiency, the optimal ownership concentration exhibits some degree of dispersion.

In practice, the ownership concentration of firms may not correspond to the optimal ownership concentration derived in this paper. In particular, (stock market) liquidity and diversification motives may necessitate that share ownership is widely dispersed, implying that there may be too little intervention or monitoring compared to the optimal level.[4] In this case, we show that monitoring incentives can alternatively be provided by increasing the firm's debt. Intuitively, an increase in leverage increases the possible gains from risk-taking, thus providing shareholders with greater incentives to intervene and implement their preferred project choice. Although this entails an increase in the agency costs of debt, the increase is more than offset by the reduction in managerial on-the-job consumption induced by the additional monitoring.

By allowing firms to choose between small, internally financed projects and large, debt-financed projects, we show that under certain conditions, firms with a high own-

[3] On this point, see also Acemoglu (1995) and Myers (1996).

[4] See Demsetz and Lehn (1985) regarding risk diversification, and Holmström and Tirole (1993) and Bolton and von Thadden (1998) regarding stock market liquidity.

ership concentration may voluntarily choose smaller, albeit less profitable projects to avoid excessively high agency cost of debt. Accordingly, the inability of firms with concentrated ownership to commit not to engage in risk-taking may, as an extreme consequence, lead to a decline of external (more precisely: debt) finance. This is consistent with empirical evidence showing that firms controlled by a large, single owner or family are more financially constrained than manager-controlled firms.

A straightforward way to commit not to use control rights to the detriment of a debtholder is to *delegate* these rights to the debtholder. Delegation of control rights to banks via proxy votes is common practice in Germany and a few other European countries. As the debtholder is mainly interested in securing repayment of his loan though, the delegation may result in an overly safe project choice. Besides, it is unclear to what extent the debtholder has an interest in constraining managerial on-the-job consumption. But even if the benefits from delegation outweigh the costs, delegation of control rights may not be a relevant alternative as the shareholders have a natural incentive to revoke their decision once the debt is in place.[5] As is shown, the extent to which shareholders can commit to revoke their decision depends critically on the underlying ownership concentration.

The rest of the paper is organized as follows. Section 2 derives an optimal ownership structure based on the tradeoff between excessive risk-taking and constraining managerial behavior. Section 3 shows that our results are robust with respect to retrading and allowing the shareholders' project choice to depend on the interest rate (cf. Stiglitz and Weiss (1981)). Section 4 discusses the extent to which ownership concentration and leverage are substitutes in providing shareholders with monitoring incentives. The choice between small, internally financed projects and large, debt-financed projects is analyzed in Section 5. Section 6 discusses the costs and benefits of delegating control rights to debtholders and derives conditions under which the delegation is credible. Section 7 concludes. All proofs are provided in the Appendix.

2 The Costs and Benefits of Managerial Discretion

2.1 The Model

Consider a firm with a manager and a large shareholder holding a fraction α of the firm's shares. The remaining fraction $(1-\alpha)$ is widely held. All agents are risk neutral.

[5] In most countries where banks may exercise votes on behalf of shareholders, the shareholders may revoke the proxy at any time. For an overview of the legal rules governing proxy voting in the European Union, see Baums (1998).

Investment Opportunity

The firm faces a profitable investment opportunity which requires capital input I. The firm's liquid funds are $L < I$, which implies that it must borrow $D = I - L$ to pursue the investment opportunity.[6] Without loss of generality, we assume that the interest rate ρ is chosen from a sufficiently large interval $[0, \overline{\rho}]$. The project's payoff is 0 with probability $1 - \pi$ and $R(\pi) > I$ with probability π, where $\pi \in [\underline{\pi}, \overline{\pi}]$, and where $R(\pi)$ is strictly decreasing in π. Hence, there is a tradeoff between safe projects (i.e. those having a high probability of earning a positive return) and projects that earn a high return in the "good" state. The expected return $\pi R(\pi)$ is assumed to be strictly concave with a unique interior maximum realized at $\pi = \pi_{FB}$, which implies that neither the safest project nor the riskiest project is the most profitable one in expected terms.

Managerial On-the-Job Consumption

The manager can divert a fraction b of the project's payoff, which can be conveniently thought of as the use of cash and corporate assets for the manager's private pleasure, such as the maintenance of exquisite company resorts or the financing of expensive business trips. In spite of the manager's consumption, however, all projects have a strictly positive net present value, i.e. $\pi R(\pi)(1 - b) \geq I$ for all π. Furthermore, on-the-job consumption is sufficiently low to ensure that the credit plus interest can always be repaid in the "good" state. Formally, b must be sufficiently small to ensure that $R(\pi)(1 - b) > (1 + \rho) D$ for all $\pi \in [\underline{\pi}, \overline{\pi}]$ and $\rho \in [0, \overline{\rho}]$. Among other things, this implies that shareholders are never indifferent between two projects merely because they get a payoff of zero under each project.

Monitoring Technology

In line with some of the recent literature, we distinguish between "formal" and "real" control (Aghion and Tirole 1997; Burkart, Gromb, and Panunzi 1997). While equity ownership comes with control rights, these rights are of no value unless the holder acquires information to use them effectively. Insofar as control rights serve to constrain managerial behavior, we refer to the acquisition of information as "monitoring". Since monitoring is costly, we can reasonably assume that only the large shareholder monitors. Formally, the large shareholder chooses a value $m \in [0, 1]$, which represents the probability that monitoring is successful. The monitoring cost function $c(m)$ is strictly

[6] We abstract from the possibility of financing the investment with new equity by assuming that the costs of conducting an equity offering are too high compared to the expected return from the investment. Additionally, debt financing entails considerable tax benefits. Due to these (and many other) reasons, equity issues play a negligible role in the financing of new investments empirically (Mayer 1990; Corbett and Jenkinson 1997; Hackethal 1999).

increasing and strictly convex with $c(0) = 0$, $c'(0) = 0$, $c'''(\cdot) < 0$, and $\lim_{m \to 1} c'(\cdot) = K$, where K is sufficiently large. If the large shareholder's monitoring effort is successful, we say that he is in control. In the present context, control means two things: i) the large shareholder can prevent managerial on-the-job consumption, and ii) the large shareholder is sufficiently informed about the possible projects to make a meaningful choice. Formally, if the large shareholder has control, we assume that b is zero and allow the large shareholder to choose a project π from the interval $[\underline{\pi}, \overline{\pi}]$. If the large shareholder's monitoring effort is unsuccessful, the manager is in control. In this case, the manager chooses a project and diverts a fraction $b > 0$ of the project's return.[7,8]

Sequence of Events

The timing is as follows. At date 1, the manager borrows an amount D at interest rate ρ on behalf of the firm. Credit markets are perfectly competitive, which implies that the manager makes a take-it-or-leave-it offer which the creditor can either accept or reject. Subsequently, the amount $I = L + D$ is sunk. At date 2, the large shareholder chooses a monitoring level m, which determines the probability with which monitoring is successful. If monitoring is successful, the large shareholder has control; otherwise the manager has control. At date 3, whoever is in control selects a project variant π. Moreover, if the manager is in control, he also diverts a fraction b of the project's return. Subsequently, the firm is liquidated. As usual, the game is solved backwards.

2.2 Project Choice, Monitoring, and Credit Decision

Date 3: Project Choice

Suppose first the manager is in control. He solves

$$\max_{\pi} \pi R(\pi) b,$$

which has a unique interior solution $\pi_M^* = \pi_{FB}$. Thus, self-interested managerial behavior

[7] In principle, the large shareholder can select a project even if he is uninformed, e.g. by picking one at random. This can be conveniently ruled out by enlarging the range of project payoffs to include sufficiently low values $R < R(\pi)$. The function $R(\pi)$ then merely represents the "efficient frontier". As the manager always selects a payoff from the efficient frontier, it is strictly optimal for an uninformed shareholder to "rubberstamp" the manager's decision (Aghion and Tirole 1997).

[8] To focus on the role of monitoring in constraining managerial behavior, we assume that managerial on-the-job consumption and project choice are not observable unless monitoring by the large shareholder is successful, in which case he can dictate the manager what (not) to do. To rule out incentive contracts based on project payoffs, we assume that the manager has sufficient leeway to manipulate accounting variables and book returns.

need not necessarily result in allocative distortions regarding project choice.[9] Next, suppose the large shareholder is in control. He solves

$$\max_{\pi} \left\{ \pi \max \alpha \left[R(\pi) - (1+\rho) D, 0 \right] \right\}. \tag{1}$$

Recall that $R(\pi) > (1+\rho) D$. The following assumption ensures that the large shareholder's objective function is strictly decreasing in π, implying that $\pi_S^* = \underline{\pi}$.

Assumption 1: $\frac{d}{d\pi} \pi R(\pi) \Big|_{\pi=\underline{\pi}} < D.$

Section 3.1 examines the opposite case where the large shareholder's problem has an interior solution. As is shown, the optimal project choice π_S^* then depends on the underlying interest rate. Other than that, however, Assumption 1 has no effect on our results. Since $\underline{\pi} R(\underline{\pi}) < \pi_{FB} R(\pi_{FB})$, the project chosen by the large shareholder is inefficient. Hence, leverage drives a wedge between the ex ante and ex post optimal project choice (Jensen and Meckling 1976). Among other things, this implies that allowing the manager to have discretion over the choice of project may be of value.

Date 2: Monitoring

Given the optimal decisions at date 3, the large shareholder solves

$$\max_{m} \left\{ m \underline{\pi} \alpha \left[R(\underline{\pi}) - (1+\rho) D \right] + (1-m) \pi_{FB} \alpha \left[R(\pi_{FB})(1-b) - (1+\rho) D \right] - c(m) \right\},$$

which has a unique solution m^* defined by

$$\alpha \Delta = c'(m^*), \tag{2}$$

where

$$\Delta = \underline{\pi} \left[R(\underline{\pi}) - (1+\rho) D \right] - \pi_{FB} \left[R(\pi_{FB})(1-b) - (1+\rho) D \right].$$

By revealed preference, $\Delta > 0$. Hence, the large shareholder monitors more the greater his share of the firm's equity (expressed by α), the greater the ex post gains from risk-taking (expressed by the debt level D and the interest rate ρ), and the greater the benefits from reducing managerial on-the-job consumption (expressed by b).

[9] In a similar vein, Stein and Scharfstein (1997) note that "the CEO's ability to appropriate private benefits should ultimately be roughly in line with the value of the enterprise as a whole. To put it simply, while agency-prone CEOs may want big empires, it also seems reasonable that, holding size fixed, they will want valuable empires." For our argument, it is not crucial that the manager favors the most efficient project. What is important though is that he does not favor the riskiest project $\underline{\pi}$. Alternatively, this could be motivated by assuming that the manager puts some weight on protecting his firm-specific human capital.

Date 1: Credit Decision

At date 1, the manager offers the creditor an interest rate ρ that maximizes his expected future on-the-job consumption. He solves

$$\max_{\rho} (1 - m^*) \pi_{FB} R(\pi_{FB}) b \quad (3)$$

subject to the creditor's zero profit constraint

$$m^* \underline{\pi} (1 + \rho) D + (1 - m^*) \pi_{FB} (1 + \rho) D \geq D. \quad (4)$$

As the optimal monitoring level is strictly increasing in ρ, the manager chooses the smallest interest rate satisyfing (4) to provide the large shareholder with as little monitoring incentives as possible.[10] Denote this interest rate by ρ_0. Incidentally, if the take-it-or-leave-it offer were made by the large shareholder (assuming $\alpha > 0$), the choice of interest rate would be exactly the same, albeit for a different reason. To see this, denote the large shareholder's utility by V. Since m^* is chosen optimally at date 2, it follows that

$$\frac{dV}{d\rho} = \frac{\partial V}{\partial \rho} = -\alpha D [m^* \underline{\pi} + (1 - m^*) \pi_{FB}] < 0. \quad (5)$$

Thus, the large shareholder cares only about the direct effect of the interest rate on the value of the firm's equity, which is of course negative.

To summarize, at date 1 the manager offers $\rho = \rho_0$, which is the lowest interest rate satisfying the creditor's zero profit constraint (4). Among other things, this implies that (4) must be binding. Subsequently the large shareholder chooses his monitoring effort according to (2), where the optimal monitoring level m^* depends on both ρ_0 and α. Finally, if the large shareholder is in control, he selects $\pi_S^* = \underline{\pi}$, and if the manager is in control, he selects $\pi_M^* = \pi_{FB}$ and consumes $bR(\pi_{FB})$ with probability π_{FB} and zero with probability $1 - \pi_{FB}$. While solving the game backwards, we have hitherto taken the ownership structure as given. In the following section, we explicitly examine how the equilibrium choices m^* and ρ_0 vary with the underlying ownership concentration and derive, among other things, implications for an optimal ownership structure.

2.3 Optimal Ownership Concentration

Leaving the manager with discretion comes with both benefits and costs. On the one hand, managerial discretion is beneficial as it helps to reduce the agency costs of debt caused by the large shareholder's inability to commit to the efficient project choice. In a

[10] To be precise, if $\alpha = 0$, the manager is indifferent with respect to his choice of ρ. In this case, we *assume* that the manager chooses the smallest feasible interest rate.

sense, this is an application of the well-known result that in the face of a time consistency problem, it may be optimal to hand over control to a party with conflicting interests. On the other hand, managerial discretion comes with costs as it leads to shirking and on-the-job consumption. If the costs of managerial discretion outweigh the benefits, committing to refrain from monitoring may be desirable from an ex ante point of view. As the preceeding analysis has shown, the extent to which such commitment is credible depends, among other things, on the underlying ownership concentration.

In the light of this commitment problem, we now derive the optimal ownership concentration trading off the costs and benefits of managerial discretion. Prior to doing so, however, we consider the case where the large shareholder can commit to choose his monitoring effort ex ante (i.e. before the credit is awarded). Define

$$\omega = \pi_{FB} R(\pi_{FB})\, b - [\pi_{FB} R(\pi_{FB}) - \underline{\pi} R(\underline{\pi})]$$

as a measure of the relative importance of the costs of risk-shifting (low ω) and the costs of managerial on-the-job consumption (high ω). If monitoring (but not project choice) is contractible and side payments between the small shareholders and the large shareholder are possible (first-best case), the optimal monitoring level maximizes total shareholder wealth defined by

$$\begin{aligned} W &= E - c(m) \\ &= m\underline{\pi}\,[R(\underline{\pi}) - (1+\rho_0)\, D] \\ &\quad + (1-m)\,\pi_{FB}\,[R(\pi_{FB})\,(1-b) - (1+\rho_0)\, D] - c(m) \\ &= m\omega + \pi_{FB} R(\pi_{FB})\,(1-b) - D - c(m)\,, \end{aligned} \tag{6}$$

where E denotes the (gross) value of the firm's equity, and where the second equality follows from inserting the creditor's zero profit condition (4). Clearly, if $\omega \leq 0$, i.e. if risk-shifting is more severe than managerial on-the-job consumption, the first-best monitoring level is zero. On the other hand, if $\omega > 0$, the first-best monitoring level is strictly positive and defined by

$$\omega = c'(m_{FB})\,. \tag{7}$$

Consider now the case where monitoring is not contractible but where the large shareholder can commit to choose his monitoring effort ex ante (commitment case). Given that he must bear the entire monitoring cost himself, the large shareholder solves

$$\max_m \{\alpha E - c(m)\}\,.$$

By inspection, if $\omega \leq 0$, the optimal monitoring level under commitment corresponds to the first-best monitoring level. On the other hand, if $\omega > 0$, the optimal monitoring level under commitment satisfies

$$\alpha\omega = c'\left(m_C^*\right).$$

This provides us with the following proposition.

Proposition 1: *Suppose the large shareholder can commit to choose his monitoring effort ex ante. If* $\omega \leq 0$, *any ownership concentration is optimal. Conversely, if* $\omega > 0$, *the unique optimal ownership concentration is* 1.[11]

Thus, if monitoring is beneficial (i.e. if $\omega > 0$), the optimal ownership arrangement under commitment is to have the large shareholder own the entire firm, which implies that he fully internalizes the costs and benefits from his monitoring activity. Consider now the original case where the large shareholder cannot commit to choose his monitoring effort ex ante. By (2), the optimal monitoring level then satisfies

$$\alpha\left[\omega + \left[\pi_{FB} - \underline{\pi}\right]\left(1+\rho_0\right)D\right] = c'\left(m^*\right).$$

If $\omega > 0$, setting $\alpha = 1$ yields $m^* > m_{FB}$, i.e. there is *overmonitoring* relative to the first-best monitoring level. To provide the large shareholder with the right monitoring incentives, α must therefore be strictly less than 1. More precisely, α must satisfy

$$\alpha\left[\omega + \left[\pi_{FB} - \underline{\pi}\right]\left(1+\rho_0\right)D\right] = \omega,$$

where the equilibrium interest rate ρ_0 is a nontrivial function of α (see below).

Proposition 2: *Suppose the large shareholder cannot commit to choose his monitoring effort ex ante. If* $\omega \leq 0$, *the unique optimal ownership concentration is* 0. *If* $\omega > 0$, *the unique optimal ownership concentration lies strictly between* 0 *and* 1.

The optimal ownership concentration is derived from a system of equations taking into account that the optimal monitoring level m^* depends on the equilibrium interest rate ρ_0 via (2), that ρ_0 depends on m^* via the creditor's zero profit condition (4), and that both variables in turn depend on the underlying ownership concentration. As an illustration, consider the effect of a change in the underlying ownership concentration on total shareholder wealth (6). Differentiating W with respect to α, we have

$$\frac{dW}{d\alpha} = \frac{\partial W}{\partial m^*}\frac{dm^*}{d\alpha} + \frac{\partial W}{\partial \rho_0}\frac{d\rho_0}{d\alpha},$$

[11] By assumption, the "optimal" ownership concentration is that which maximizes total shareholder wealth W. Thus, we implicitly adopt the viewpoint of an initial owner who wants to sell all or part of his shares in a going public transaction.

where

$$\frac{dm^*}{d\alpha} = \frac{\partial m^*}{\partial \rho_0}\frac{d\rho_0}{d\alpha} + \frac{\partial m^*}{\partial \alpha}, \tag{8}$$

and

$$\frac{d\rho_0}{d\alpha} = \frac{\partial \rho_0}{\partial m^*}\frac{dm^*}{d\alpha}.$$

According to (8), α affects the ex post optimal monitoring level both directly (a higher ownership concentration improves the large shareholder's monitoring incentives), and indirectly through a feedback effect (more monitoring leads to more risk-shifting, implying that the equilibrium interest rate ρ_0 must rise for the creditor to break even, which in turn leads to more monitoring). Overall, the effect of α on m^* is positive. As the Appendix shows, total shareholder wealth W is quasiconcave in α and has a unique interior maximum $\alpha^* \in (0, 1)$. Hence, an increase in α is beneficial for low ownership concentrations and detrimental for high ownership concentrations.

3 Interior Project Choice and Retrading

3.1 Interior Project Choice

In the preceeding section, the large shareholder, when in control, always chooses the "corner project" $\underline{\pi}$ regardless of the underlying interest rate. Formally, this is due to Assumption 1, which ensures that the large shareholder's objective function (1) is strictly decreasing over the entire range $[\underline{\pi}, \overline{\pi}]$. The purpose of this section is to show that our results remain unchanged if Assumption 1 is relaxed. In particular, we now examine the other polar case where the large shareholder always chooses an "interior project" $\pi > \underline{\pi}$. For this reason, we replace Assumption 1 with the following assumption, which ensures that (1) is strictly increasing at $\pi = \underline{\pi}$.

Assumption 2: $\frac{d}{d\pi}\pi R(\pi)\Big|_{\pi=\underline{\pi}} > D(1+\overline{\rho})$,

Given Assumption 2, the large shareholder's problem of choosing an optimal project has a unique interior solution π_S^* satisfying

$$\pi_S^* R'(\pi_S^*) + R(\pi_S^*) - (1+\rho) D = 0. \tag{9}$$

Differentiating (9) with respect to ρ, we have

$$d\pi_S^*/d\rho < 0,$$

i.e. a higher interest rate leads to a riskier project choice. Accordingly, allowing the large shareholder to choose an interior project exacerbates the risk-shifting problem between the firm's shareholders and the creditor. Not only does a higher interest rate lead to more monitoring, thereby increasing the probability that risk-shifting takes place. A higher interest rate now also increases the (ex ante) inefficiency caused by risk-shifting conditional upon the fact that risk-shifting takes place. In the extreme case, this may imply that there exists no equilibrium in which the creditor earns zero profit, thereby leading to credit rationing (Stiglitz and Weiss 1981). In our model, we have carefully avoided this problem by assuming that all projects are sufficiently profitable.

Going through the same steps as before, one can derive an optimal ownership concentration which takes into account the costs and benefits of managerial discretion. The analysis is the same as in Section 2, except that the dependence of π_S^* on ρ_0 introduces additional feedback effects. For instance, the optimal monitoring effort m^* now depends on ρ_0 both directly and indirectly (via π_S^*). Likewise, an increase in the equilibrium interest rate ρ_0 leads to a riskier project choice, which in turn raises the equilibrium interest rate, which leads to an even riskier project choice, and so forth. Denote by

$$\rho_{FB} = 1/\pi_{FB} - 1$$

the equilibrium interest rate that obtains if $\alpha = 0$, and define

$$\eta(\rho) = \pi_S^*(\rho) R(\pi_S^*(\rho)) - \pi_{FB} R(\pi_{FB}) + \pi_{FB} R(\pi_{FB}) b,$$

where $\pi_S^*(\rho)$ is the project chosen by the large shareholder if the underlying interest rate is ρ. Analogous to Proposition 2, we have the following result.

Proposition 3: *Suppose it is optimal for the large shareholder to select an interior project. If $\eta(\rho_{FB}) \leq 0$, the unique optimal ownership concentration is 0. If $\eta(\rho_{FB}) > 0$, the unique optimal ownership concentration lies strictly between 0 and 1.*

3.2 Retrading

As the large shareholder cannot commit to a particular monitoring level, he must be provided with the right incentives to monitor. As was shown in Proposition 2, this gives rise to an optimal ownership concentration that is strictly less than 1. After the credit is sunk, monitoring is purely beneficial though, implying that the shareholders as a whole could be made better off if share ownership were more concentrated. In fact, due to the public good nature of monitoring, ex post shareholder wealth is maximimized if the large shareholder owns the entire firm. Hence, the ability to retrade may be detrimental ex ante as it destroys the commitment power that comes with dispersed share ownership. As the following proposition shows, however, retrading is not a problem if the fraction $1 - \alpha$ not owned by the large shareholder is widely dispersed.

Proposition 4: *The large shareholder has no incentive to alter his stake by retrading if all investors know the size of the trades and the identity of the traders.*

The proof is standard and omitted for the sake of brevity.[12] The idea is based on an argument by Grossman and Hart (1980) that widely dispersed (more precisely: atomless) shareholders will refuse to sell their shares unless the offered price reflects the full posttrade share value. To see this, suppose the ownership concentration is increased from, say, α to $\alpha + \delta$. Due to the free-rider problem, the large shareholder realizes no gains on the fraction of traded shares δ. His net gains from trading are therefore

$$\alpha E\left(m^*\left(\alpha+\delta\right)\right) - c\left(m^*\left(\alpha+\delta\right)\right) - \left[\alpha E\left(m^*\left(\alpha\right)\right) - c\left(m^*\left(\alpha\right)\right)\right],$$

where $m^*(\alpha)$ is the large shareholder's optimal monitoring effort if the underlying ownership concentration is α. By revealed preference, this expression is negative as $\alpha E(m) - c(m)$ is maximized at $m^*(\alpha)$. In other words, the gain on his toehold is not sufficient to compensate the large shareholder for the additional monitoring costs. By a similar argument, a decrease in α is not profitable either.

4 Capital Structure and Monitoring Incentives

For various reasons, the ownership concentration of firms may not correspond to the optimal level derived in Section 2. For instance, the founding family may want to retain a higher than optimal stake to ensure that the firm continues to be run in the interest of the founding father. Conversely, the firm's actual ownership concentration may be lower than optimal for liquidity or diversification reasons. In this section, we show that in the latter case, the firm's capital structure may serve as an alternative instrument to provide the large shareholder with the right incentives to monitor.

Consider the following variant of our model. Instead of borrowing $D = I - L$, the firm can pay out a dividend $0 \leq d \leq L$ and simultaneously borrow $I - (L - d) = D + d$ to finance the investment. Again, we assume that the investment is sufficiently profitable to ensure that the credit plus interest, which now amounts to $(D + d)(1 + \rho)$, can always be repaid in the "good" state. The intuition why an increase in leverage might matter is as follows. If the ownership concentration is below the optimal level, there is *undermonitoring* relative to the first-best monitoring level (7). Holding everything else constant, an increase in D increases the large shareholder's monitoring effort as it increases the gains from risk-taking expressed by

$$\left[\pi_{FB} - \underline{\pi}\right](1+\rho) D.$$

[12] For a formal proof, see, e.g., Burkart, Gromb, and Panunzi (1997).

The problem is that this *ceteris paribus* assumption is invalid due to the interdependence of the optimal monitoring level m^* and the equilibrium interest rate ρ_0. Fortunately though, the additional feedback effect via ρ_0 works in the right direction, i.e. an increase in monitoring induced by an increase in leverage raises the equilibrium interest rate, which in turn increases the large shareholder's monitoring effort. The following proposition formalizes the above discussion.

Proposition 5: *An increase in leverage increases total shareholder wealth if and only if the firm's ownership concentration is below the optimal level.*

Thus, to the extent that the ownership concentration is below the optimal level, leverage and ownership concentration are substitutes in providing monitoring incentives. If, however, the ownership concentration is higher than optimal, there is *overmonitoring* relative to the first-best level. In this case, an increase in leverage worsens the situation as it provides the large shareholder with yet even stronger incentives to monitor.

5 The Decline of External Finance

As the creditor rationally anticipates the large shareholder's project choice, the agency costs of debt are solely borne by the firm's shareholders. The dilemma, of course, is that the shareholders cannot avoid these costs as they face a time consistency problem. A possibility not yet considered is to reduce the agency costs by investing in a scaled-down project that requires less or no debt finance. In practice, such a possibility is often available. For instance, firms pursuing growth through acquisitions may have the choice between acquiring smaller or larger companies. To model the choice between projects of different sizes, we assume that the firm can either borrow D and invest in a large-scale project requiring capital input $I = L + D$, or invest in a small-scale but internally financed project requiring capital input $i \leq L$. For convenience, we assume that the large-scale project is a "blown-up" version of the small-scale project with the same rate of return $\tau(\pi)$ in the "good" state. Expected returns for the large- and small-scale project are then $\pi R(\pi) = \pi I (1 + \tau(\pi))$ and $\pi r(\pi) = \pi i (1 + \tau(\pi))$, respectively.

Suppose the firm goes ahead with the small-scale project. As there is no debt agency problem, the large shareholder, when in control, chooses the efficient project π_{FB}. Next, consider the large shareholder's choice of monitoring effort. He solves

$$\max_m \{m\pi_{FB}\alpha r(\pi_{FB}) + (1-m)\pi_{FB}\alpha r(\pi_{FB})(1-b) - c(m)\},$$

which has a unique solution m_E^* satisfying

$$\pi_{FB}\alpha r(\pi_{FB})\, b = c'(m_E^*). \tag{10}$$

By inspection, the optimal monitoring effort under the small-scale project is less than under the large-scale project. Intuitively, this is due to the fact that risk-shifting is ex post beneficial, thus providing additional incentives for the large shareholder to gain control.[13] Total shareholder wealth under the small-scale project is then

$$W_E = \pi_{FB} r(\pi_{FB}) [m_E^* + (1 - m_E^*)(1 - b)] + [L - i] - c(m_E^*).$$

Finally, observe that in the absence of risk-shifting, monitoring is purely beneficial from the shareholders' point of view, which implies that the optimal ownership arrangement under the small-scale project is to have the large shareholder own the entire firm.

The costs and benefits of choosing the small-scale project are as follows. Since the small-scale project is a scaled-down version of the large-scale project, investing in the former means foregoing expected profits. On the other hand, as the small-scale project is exclusively financed with internal funds, the agency costs of debt are zero. Moreover, monitoring under the small-scale project is strictly lower than under the large-scale project, which may or may not be beneficial, depending on the relative costs of risk-taking versus managerial on-the-job consumption. If the costs of risk-taking are low relative to those of on-the-job consumption, implying that monitoring is beneficial, both effects (i.e. the greater profit and the higher level of monitoring under the large-scale project) point in the direction of favoring the large-scale project. To exclude this rather uninteresting case, we assume that the costs of risk-taking are sufficiently high, i.e. $\omega \leq 0$. For ease of exposition, denote by $W_E(\alpha, i)$ total shareholder wealth under the small-scale project if the investment level is i, and define $\kappa = [W_E(\alpha, L) - W(\alpha)]|_{\alpha=1}$.

Proposition 6: *Suppose $\omega \leq 0$. Whether total shareholder wealth is greater under the small- or large-scale project depends on the ownership concentration as follows.*

Case 1: *If $\kappa \leq 0$, then $W_E(\alpha, i) - W(\alpha) \leq 0$ for all α and $i \leq L$.*

Case 2: *If $\kappa > 0$, there exists a unique value $0 < \overline{\alpha} < 1$ and, for all $\alpha > \overline{\alpha}$, a unique threshold $0 < \overline{i}(\alpha) < L$ such that*

i) $W_E(\alpha, i) > W(\alpha)$ if and only if $\alpha > \overline{\alpha}$ and $\overline{i}(\alpha) < i \leq L$,

ii) $\overline{i}(\alpha)$ is strictly decreasing in α.

In Case 1, the difference in size between the small- and large-scale project is considerable. As foregone profits are proportional to this differenc, the large-scale project dominates the small-scale project for all possible ownership concentrations. Case 2 is

[13] This effect was discussed at length in the previous section. A second, albeit less important reason why monitoring is greater under the large-scale project is that the costs of managerial on-the-job consumption are higher compared with those under the small-scale project.

more interesting. There, it may pay off for firms with a high ownership concentration to invest in the small-scale project as long as the small-scale project is not too small. Thus, unlike standard models of credit-rationing where firms are denied access to credit finance, firms in our model may *voluntarily* do without credit to avoid excessively high agency costs of debt. Put it somewhat more ornately, the inability of large shareholders to commit not to use their control rights to the detriment of creditors may, as an extreme consequence, lead to a decline of external (more precisely: credit) finance. Furthermore, as the ownership concentration rises, the range of small-scale projects under which internal finance is optimal becomes larger, implying that a decline of external finance is more likely for firms with concentrated ownership.

Indirect support for our theory comes from the casual observation that startup firms are either financed with venture (i.e. equity) capital, in which case there is no debt-agency problem, or with bank loans, in which case the bank's grip on the firm's owner-manager(s) is usually sufficiently tight to rule out excessive risk-taking. By contrast, large corporations, which are often widely dispersed (at least in the United States), frequently resort to the public bond market where control by bondholders is loose.

Further evidence comes from Weigand and Audretsch (1999). Among other things, they investigate the relationship between ownership concentration and financing constraints for 342 German firms, most of which are stock corporations. They define a firm as owner-controlled if individuals or families have a stake of over 25%, and as manager-controlled if the stake of individuals or families is less than 25%. For large firms (i.e. firms having 500 or more employees), Weigand and Audretsch find that manager-controlled firms are less constrained than owner-controlled firms.[14] For small firms, their results are not significant. The authors conclude (p.24): "Firm owners, who are often also the founders of the respective firms, may not be willing to resign from total control and rather prefer slower growth by accepting financing constraints". Observe though that these results are merely *consistent* with our theory. To distinguish our theory from others, it is necessary to show that the financing constraints are due to excessive risk-taking (and not, e.g., because the large shareholder diverts part of the firm's profits).

6 Delegation of Control Rights

A straightforward (perhaps *the* most straightforward) way of committing not to use control rights to the detriment of a creditor is to hand over or delegate the control rights to the creditor. In Germany and a few other European countries, delegation

[14] In their study, a firm is financially constrained if investment expenditures are positively related to the firm's cash flow and sales, and negatively related to the year-to-year change in working capital.

of control rights to banks via proxy votes is common practice. For instance, in 1992, banks controlled on average 84% of the votes at annual shareholder meetings of the 24 largest widely held German stock corporations (Baums and Fraune 1995). Of these 84%, approximately 75% (i.e. 61% in absolute terms) came from depositary proxy votes. From a theoretical viewpoint, this raises (at least) two questions:

1) What are the costs and benefits of delegation?

2) What makes the delegation credible?

At this point, some comments are in order. With regard to the first question, note that we do not assert that shareholders consciously weigh up the costs and benefits of delegation when appointing a proxy. In fact, the decision may be purely mechanical (as is frequently claimed). In line with traditional reasoning, however, we may view the outcome of the decision *as if* it ensued from a rational and conscious choice by utility-maximizing agents.[15] With regard to the second question, the issue of credibility arises because the proxy, albeit valid for a maximum of 15 months, can be revoked at any time.[16] Moreover, to the extent that the credit is long-term, the bank must rely on the proxy being renewed after it has expired.

The main point of this section is that the answer to both questions depends critically on the firm's ownership concentration. In our model, the costs and benefits of delegating control rights are as follows. While risk-taking is no longer an issue, there is the new problem that the creditor may choose an overly safe project to secure repayment of his loan. Besides, it is unclear to what extent the creditor has an interest in constraining managerial behavior. As excessive on-the-job consumption may endanger repayment of the credit though, we assume that the creditor's interest is at least partly aligned with that of the shareholders. Formally, we assume that when the creditor is in control, the manager only consumes a fraction $b_C < b$ of the project's return. When the manager is in control, everything remains the same.

As usual, the game is solved backwards. At date 3, the creditor solves

$$\max_{\pi} \pi \min \left[(1+\rho) D, R(\pi) \right].$$

[15] There are still a few caveats though. Most importantly, as the proxy is awarded to the bank where the shareholder has his brokerage account, proxies may be voted by banks with whom the firm has no credit relationship. In our model, we abstract from this possibility by assuming that control rights are directly delegated to the creditor. Additionally, proxy votes are typically spread over several banks, implying that there may be dissent over how to cast the votes. In Germany (and similarly also in Austria), this problem is partly resolved by the fact that on average more than 40% of the votes are controlled by the three big banks, Deutsche Bank, Dresdner Bank, and Commerzbank (Baums and Fraune 1995). To the extent that these banks fully control each other at their own shareholder meetings, they may be conveniently viewed as a single entity (Baums 1995).

[16] This is the case for Germany and Austria.

As $R(\pi) > (1+\rho) D$, the problem has a unique solution $\pi_C^* = \overline{\pi}$. Accordingly, the creditor chooses the safest project to safeguard repayment of his credit. Next, consider the monitoring decision. For convenience, we assume that the monitoring technology is the same as that of the large shareholder. The creditor solves

$$\max_m \left\{ m\overline{\pi}(1+\rho) D + (1-m) \pi_{FB} (1+\rho) D - c(m) \right\},$$

which has a unique interior solution m_C^* satisfying

$$\left[\overline{\pi} - \pi_{FB}\right](1+\rho) D = c'\left(m_C^*\right). \tag{11}$$

At date 1, the manager makes a take-it-or-leave-it offer to the creditor. As the creditor rationally anticipates all future decisions, the equilibrium interest rate will depend on whether the creditor remains in control or not. In the latter case, the outcome is the same as in Section 2. In case the creditor retains control, the manager solves

$$\max_\rho m_C^* \overline{\pi} R(\overline{\pi}) b_C + \left(1 - m_C^*\right) \pi_{FB} R(\pi_{FB}) b.$$

Since

$$\frac{dm_C^*}{d\rho} = \frac{\left[\overline{\pi} - \pi_{FB}\right] D}{c''\left(m_C^*\right)} > 0,$$

the manager offers the lowest interest rate satisfying the creditor's zero profit constraint

$$m_C^* \overline{\pi}(1+\rho) D + \left(1 - m_C^*\right) \pi_{FB}(1+\rho) D - D - c\left(m_C^*\right) \geq 0, \tag{12}$$

implying that (12) must hold with equality.

If the delegation is credible, total shareholder wealth under delegation is

$$W_C = m_C^* \overline{\pi} R(\overline{\pi})(1 - b_C) + \left(1 - m_C^*\right) \pi_{FB} R(\pi_{FB})(1 - b) - D - c\left(m_C^*\right),$$

whereas total shareholder wealth under non-delegation is

$$W = m^* \underline{\pi} R(\underline{\pi}) + (1 - m^*) \pi_{FB} R(\pi_{FB})(1 - b) - D - c(m^*).$$

Hence, if the ownership concentration is low (implying that m^* is small), delegation is beneficial if the expected return from the creditor's preferred project is not too low compared to the efficient project, if managerial on-the-job consumption under creditor control is sufficiently low, and if the creditor's monitoring costs are not too high as the shareholders must reimburse him for his services via a higher interest rate. Conversely, if the ownership concentration is high, delegation is beneficial if the costs of risk-shifting are high compared to those of letting the creditor implement the safe project, if on-the-job consumption under both manager and creditor control is moderate, and if the creditor's monitoring costs are low compared to those of the large shareholder.

While the net benefits from delegation may be positive, the choice between delegation and non-delegation is hypothetical if the shareholders cannot commit not to revoke their decision once the credit is sunk. As the creditor foresees this, he will rationally charge the same interest rate as if there was no delegation. Thus, prior to examining whether the delegation is beneficial, one must examine whether it is credible. In this regard, note that whenever it is optimal for the large shareholder to withdraw his control rights, this is also optimal for the diffuse shareholders as the large shareholder bears the full monitoring cost and security interests are congruent. Conversely, if it is optimal for the large shareholder *not* to withdraw his control rights, the decision of the diffuse shareholders is inconsequential.[17] Together, this implies that the delegation is credible if and only if the large shareholder has no incentives to revoke his decision.

In the special case where $\alpha = 0$, the large shareholder's payoff is zero under either regime (i.e. delegation versus non-delegation), implying that he is indifferent between revoking and not revoking his decision. We therefore assume that $\alpha > 0$. Define

$$\varphi = \overline{\pi} R(\overline{\pi})(1 - b_C) - \pi_{FB} R(\pi_{FB})(1 - b) - (\overline{\pi} - \pi_{FB}) D\left(1 + \rho_0^B\right), \tag{13}$$

where ρ_0^B is the smallest interest rate satisfying (12). By the above reasoning, ρ_0^B is the equilibrium interest rate if the delegation is credible.

Proposition 7: *Suppose $\alpha > 0$. Whether the delegation of control rights to the creditor is credible depends on the ownership concentration as follows.*

i) If $\varphi \leq 0$, the delegation is not credible for all α.
ii) If $\varphi > 0$ and the delegation is not credible for $\alpha = 1$, there exists a unique value $0 < \bar{\alpha} < 1$ such that the delegation is credible if and only if $\alpha \leq \bar{\alpha}$.
iii) If $\varphi > 0$ and the delegation is credible for $\alpha = 1$, it is credible for all α.

Cases i) and iii) are only moderately interesting. In case i), the expected return of the project chosen by the creditor net of managerial consumption is sufficiently low, implying that the large shareholder is better off monitoring even though he must bear the full monitoring cost (recall that ex post, monitoring is always beneficial). Case iii) represents the opposite case where the expected return from the safe project is sufficiently high and managerial consumption under creditor control sufficiently low such that it never pays for the large shareholder to withdraw his control rights. The intermediate case ii) is more interesting. If share ownership is sufficiently dispersed, there is too little monitoring by the large shareholder, implying that the shareholders (including the large shareholder

[17] This is because the diffuse shareholders cannot *force* the large shareholder to monitor. Hence, even if the fraction $1 - \alpha$ of votes belonging to the small shareholders is withdrawn, the creditor, controlling the large shareholder's voting block, has still formal control.

himself) can realize only a small part (in expected terms) of the ex post gains from interfering (viz., implementation of their preferred project and prevention of managerial shirking). In this case, the large shareholder fares better if the creditor retains control. Conversely, if the ownership concentration is high, the large shareholder monitors enough to ensure that withdrawing control from the creditor pays off.

Empirically, case ii) appears to be the most relevant one. In recent studies, both Franks and Mayer (1998) and Edwards and Nibler (1999) find that the influence of banks on firms via proxy votes in Germany is negatively related to the firms' ownership concentration. As our theory suggests, this is not merely because banks overcome the free-rider problem in monitoring and disciplining management that is characteristic for firms with dispersed share ownership.[18] If the agency costs of debt are high, even firms with a dominant shareholder may benefit from delegating control to a bank. In fact, to the extent that these agency costs are positively related to the firm's ownership concentration (as our model suggests), they may benefit even more from the delegation than firms with diffuse ownership. Thus, it is not necessarily the *desire* to delegate control what distinguishes firms, but the *ability* to do so in a credibly way.

7 Summary

This paper investigates the role of a firm's ownership concentration in allowing shareholders to commit not to exercise their control rights to the detriment of debtholders. As shareholder passivity also means granting managers more freedom, the costs of this commitment are increased managerial on-the-job consumption and shirking. Trading off the costs and benefits of managerial discretion, we derive a unique optimal ownership structure. Sometimes though, share ownership is more dispersed than optimal (e.g. to encourage active trading in the firm's shares), implying that shareholders monitor too little. In this case, we show that leverage and ownership concentration serve as alternative instruments in providing shareholders with monitoring incentives. We also show that there may be a relation between ownership concentration and growth. If excessive risk-taking by shareholders is a serious problem, firms with concentrated ownership may find it worthwhile to limit firm growth to the availability of internal funds, even if that means foregoing profitable investment opportunities.

Finally, the paper discusses the costs and benefits of delegating control rights to debtholders as a means of reducing the agency costs of debt. In Germany and a few other European countries, banks wield considerable power over firms through the exercise of proxy votes. As banks are primarily interested in securing repayment of their loans,

[18] This view is, e.g., expressed by Charkham (1994, p.38).

however, there is no a priori reason why they should use this power to enhance firm profitability.[19] In fact, we show that if banks can affect project choice, they will favor overly safe projects, which may or may not be more efficient than the risky projects favored by the firms' shareholders. Consequently, strong influence by banks may manifest itself in excessive conservatism, which is complementary to the costs of bank influence mentioned in Rajan (1992) (extraction of monopoly rents), and von Thadden (1995) (myopic investment decisions). But even when the gains from delegating control outweigh the costs, shareholders may not be able to realize these gains as they cannot commit not to withdraw their control rights once the debt is in place. Similar to the case where control rights cannot be delegated, we show that the ability of shareholders to commit depends critically on the underlying ownership concentration.

8 Appendix

Proof of Proposition 2: The proof proceeds in two steps. We first prove that the equilibrium interest rate ρ_0 is continuously differentiable in α. We then apply this result to prove the statement given in the proposition. Denote by

$$\Pi(\alpha,\rho) = m^* \underline{\pi}\,(1+\rho)\,D + (1-m^*)\,\pi_{FB}\,(1+\rho)\,D - D$$

the creditor's profit for given values of α and ρ. Since $\Pi(\alpha,0) < 0$ and $\Pi(\alpha,\overline{\rho}) > 0$, continuity of $\Pi(\alpha,\rho)$ in ρ implies that $\Pi(\alpha,\rho)$ has a unique smallest zero, which shall be denoted by ρ_0. Differentiating $\Pi(\alpha,\rho)$ twice with respect to ρ gives

$$\frac{d^2\Pi(\alpha,\rho)}{d\rho^2} = \left[2\left[\underline{\pi} - \pi_{FB}\right] D + (1+\rho)\, D^2 \left[\underline{\pi} - \pi_{FB}\right]^2 \frac{\alpha}{\left[c''\left(m^*\right)\right]^2} c'''\left(m^*\right) \right] \frac{\partial m^*}{\partial \rho},$$

which is nonpositive since

$$\frac{\partial m^*}{\partial \rho} = -\frac{\alpha D}{c''(m^*)} \left[\underline{\pi} - \pi_{FB}\right] \geq 0$$

by (2). Accordingly, $\Pi(\alpha,\rho)$ is concave in ρ, which implies that $d\Pi/d\rho|_{\rho=\rho_0} > 0$. Note that $\Pi(\alpha,\rho_0(\alpha)) = 0$ by the definition of ρ_0. The fact that $\Pi(\alpha,\rho)$ is continuously differentiable in both arguments in conjunction with $d\Pi/d\rho|_{\rho=\rho_0} > 0$ then implies that $\rho_0(\alpha)$ is continuously differentiable.

Next, consider the large shareholder's first-order condition (2) and the creditor's zero profit condition (4), which holds with equality at $\rho = \rho_0$. Totally differentiating both equations, taking α, m^*, and ρ as variables, we obtain

$$D\,(1+\rho_0)\left[\underline{\pi} - \pi_{FB}\right] dm^* + D\left[m^*\underline{\pi} + (1-m^*)\,\pi_{FB}\right] d\rho_0 = 0,$$

and

$$-c''\left(m^*\right) dm^* + \alpha D\left[\pi_{FB} - \underline{\pi}\right] d\rho_0 = -\Delta d\alpha.$$

Define

$$\Psi = -\alpha\,(1+\rho_0)\left[\pi_{FB} - \underline{\pi}\right]^2 D^2 + c''\left(m^*\right) D\left[m^*\underline{\pi} + (1-m^*)\,\pi_{FB}\right]. \tag{14}$$

[19] For a similar argument, see Edwards and Fischer (1994, Ch.9) and Edwards and Nibler (1999).

As $d\Pi/d\rho|_{\rho=\rho_0} > 0$, Ψ must be strictly positive. Using Cramer's rule, we have

$$\frac{dm^*}{d\alpha} = \frac{\Delta D\left[m^*\underline{\pi} + (1-m^*)\,\pi_{FB}\right]}{\Psi},$$

and

$$\frac{d\rho_0}{d\alpha} = \frac{\Delta D\,(1+\rho_0)\left[\pi_{FB} - \underline{\pi}\right]}{\Psi} = \left[\frac{(1+\rho_0)\left[\pi_{FB} - \underline{\pi}\right]}{m^*\underline{\pi} + (1-m^*)\,\pi_{FB}}\right]\frac{dm^*}{d\alpha}, \tag{15}$$

which implies that $dm^*/d\alpha > 0$ and $d\rho_0/d\alpha > 0$. We can now determine the optimal ownership concentration. Differentiating total shareholder wealth (6) with respect to α yields

$$\begin{aligned}\frac{dW}{d\alpha} &= \left[\Delta - c'(m^*)\right]\frac{dm^*}{d\alpha} - D\left[m^*\underline{\pi} + (1-m^*)\,\pi_{FB}\right]\frac{d\rho_0}{d\alpha} \\ &= \left[\omega - c'(m^*)\right]\frac{dm^*}{d\alpha},\end{aligned}$$

where the second equality follows from inserting (15) and the definition of ω. First, suppose $\omega \leq 0$. Clearly, $dW/d\alpha < 0$ for all $\alpha > 0$, which implies that the optimal ownership concentration is zero. Next, suppose $\omega > 0$. Evaluating $dW/d\alpha$ at $\alpha = 0$ and $\alpha = 1$ yields

$$\left.\frac{dW}{d\alpha}\right|_{\alpha=0} = \omega\frac{dm^*}{d\alpha} > 0,$$

and

$$\left.\frac{dW}{d\alpha}\right|_{\alpha=1} = \left[\omega - \Delta\right]\frac{dm^*}{d\alpha} = \left[\underline{\pi} - \pi_{FB}\right](1+\rho_0)\,D\frac{dm^*}{d\alpha} < 0.$$

Thus, the optimal ownership concentration lies strictly between 0 and 1 and satisfies

$$\omega - c'(m^*) = 0.$$

Uniqueness follows from the fact that $\omega - c'(m^*)$ is strictly decreasing in α. Q.E.D.

Proof of Proposition 3: The proof proceeds in three steps. First, we determine the optimal monitoring effort m^* and the equilibrium interest rate ρ_0. Subsequently, we show that $\rho_0(\alpha)$ is continuously differentiable. Finally, we apply these results to prove the statement given in the proposition.

At date 2, the large shareholder solves

$$\max_m \left\{m\pi_S^*\alpha\left[R(\pi_S^*) - (1+\rho)\,D\right] + (1-m)\,\pi_{FB}\alpha\left[R(\pi_{FB})(1-b) - (1+\rho)\,D\right] - c(m)\right\},$$

which has a unique solution m^* defined by

$$\alpha\Delta_S = c'(m^*), \tag{16}$$

where

$$\Delta_S = \pi_S^*\left[R(\pi_S^*) - (1+\rho)\,D\right] - \pi_{FB}\left[R(\pi_{FB})(1-b) - (1+\rho)\,D\right].$$

By revealed preference, $\Delta_S > 0$. At date 1, the manager solves

$$\max_\rho\, (1-m^*)\,\pi_{FB}R(\pi_{FB})\,b$$

subject to the creditor's zero profit constraint

$$m^*\pi_S^*(1+\rho)\,D + (1-m^*)\,\pi_{FB}(1+\rho)\,D \geq D. \tag{17}$$

Differentiating m^* with respect to ρ, we have

$$\frac{dm^*}{d\rho} = \frac{\partial m^*}{\partial \rho} = \frac{\alpha D}{c''(m^*)} [\pi_{FB} - \pi_S^*],$$

where the first equality follows from (9). Accordingly, the manager's objective function is strictly decreasing in ρ, which implies that he offers the smallest interest rate satisfying the creditor's zero profit constraint (17).[20]

By the same argument as in the proof of Proposition 2, the creditor's profit function $\Pi(\alpha, \rho)$ has a unique smallest zero ρ_0. Define $\sigma(\pi_S^*) = \pi_S^* R(\pi_S^*)$. To ensure that $d\Pi/d\rho|_{\rho=\rho_0} > 0$, we assume that $\sigma'''(\pi_S^*) < 0$ (if this does not hold, $\rho_0(\alpha)$ may be discontinuous). Differentiating $\Pi(\alpha, \rho)$ twice with respect to ρ gives

$$\begin{aligned}\frac{\partial^2 \Pi(\alpha,\rho)}{\partial \rho^2} &= 2[\pi_S^* - \pi_{FB}] D \frac{dm^*}{d\rho} + 2\frac{d\pi_S^*}{d\rho} m^* D + 2\frac{dm^*}{d\rho}(1+\rho) D \frac{d\pi_S^*}{d\rho} \\ &\quad + (1+\rho) D [\pi_S^* - \pi_{FB}] \frac{d^2 m^*}{d\rho^2} + m^*(1+\rho) D \frac{d^2 \pi_S^*}{d\rho^2},\end{aligned}$$

where $dm^*/d\rho \geq 0$, $d\pi_S^*/d\rho < 0$, $d^2\pi_S^*/d\rho^2 < 0$, and $d^2 m^*/d\rho^2 \geq 0$, which implies that $d^2\Pi/d\rho^2 \leq 0$ and therefore $d\Pi/d\rho|_{\rho=\rho_0} > 0$. From the implicit function theorem, it then follows that $\rho_0(\alpha)$ is continuously differentiable.

Finally, consider the first-order condition characterizing the large shareholder's optimal project choice (9), the first-order condition characterizing the optimal monitoring effort (16), and the creditor's zero profit condition (17), which holds with equality at $\rho = \rho_0$. Totally differentiating all three equations, taking α, π_S^*, m^*, and ρ as variables, we obtain the following equation system:

$$D(1+\rho_0)[\pi_S^* - \pi_{FB}] dm^* + D[m^*\pi_S^* + (1-m^*)\pi_{FB}] d\rho_0 + m^*(1+\rho_0) d\pi_S^* = 0,$$

$$-c''(m^*) dm^* + \alpha D[\pi_{FB} - \pi_S^*] d\rho_0 + \alpha[\sigma'(\pi_S^*) - (1+\rho_0) D] d\pi_S^* = -\Delta d\alpha,$$

and

$$-D d\rho_0 + \sigma''(\pi_S^*) d\pi_S^* = 0$$

Define

$$\begin{aligned}\Phi &= D[m^*\pi_S^* + (1-m^*)\pi_{FB}] \sigma''(\pi_S^*) c''(m^*) + m^*(1+\rho_0) D^2 c''(m^*) \\ &\quad - (1+\rho_0) D^2 [\pi_{FB} - \pi_S^*]^2 \alpha \sigma''(\pi_S^*),\end{aligned}$$

which is strictly negative as $d\Pi/d\rho|_{\rho=\rho_0} > 0$. Using Cramer's rule, we get

$$\frac{dm^*}{d\alpha} = \frac{\Delta_S \sigma''(\pi_S^*) D[m^*\pi_S^* + (1-m^*)\pi_{FB}]}{\Phi},$$

$$\frac{d\rho_0}{d\alpha} = \frac{\Delta_S \sigma''(\pi_S^*) D(1+\rho_0)[\pi_{FB} - \pi_S^*]}{\Phi},$$

and

$$\frac{d\pi_S^*}{d\alpha} = \frac{\Delta_S D^2 (1+\rho_0)[\pi_{FB} - \pi_S^*]^2 \alpha}{\Phi}.$$

[20] Strictly speaking, if $\alpha = 0$, the manager is indifferent with respect to his choice of ρ, in which case we assume that he again chooses the smallest feasible interest rate. See also footnote 9.

Hence, $dm^*/d\alpha > 0$, $d\rho_0/d\alpha > 0$, and $d\pi_S^*/d\alpha \leq 0$. Differentiating total shareholder wealth with respect to α yields

$$\frac{dW}{d\alpha} = \frac{\partial W^*}{\partial m^*}\frac{dm^*}{d\alpha} + \frac{\partial W^*}{\partial \rho_0}\frac{d\rho_0}{d\alpha} + \frac{\partial W^*}{\partial \pi_S^*}\frac{d\pi_S^*}{d\alpha}. \tag{18}$$

By the envelope theorem, $\frac{\partial W^*}{\partial \pi_S^*} = 0$. Inserting $d\rho_0/d\alpha$ in (18) gives

$$\frac{dW}{d\alpha} = \left[\eta\left(\rho_0\right) - c'\left(m^*\right)\right]\frac{dm^*}{d\alpha},$$

where

$$\eta\left(\rho_0\right) = \pi_S^*\left(\rho_0\right)R(\pi_S^*\left(\rho_0\right)) - \pi_{FB}R\left(\pi_{FB}\right) + \pi_{FB}R\left(\pi_{FB}\right)b.$$

Observe that

$$\frac{d}{d\alpha}\left[\eta\left(\rho_0\right) - c'\left(m^*\right)\right] = \sigma'\left(\pi_S^*\right)\frac{d\pi_S^*\left(\rho_0\right)}{d\alpha} - c''\left(m^*\right)\frac{dm^*}{d\alpha} < 0 \tag{19}$$

where we used the fact that $dm^*/d\alpha > 0$ and $d\pi_S^*/d\alpha \leq 0$. First, suppose $\eta\left(\rho_{FB}\right) \leq 0$. In conjunction with (19), this implies that $dW/d\alpha < 0$ for all $\alpha > 0$. Thus, the optimal ownership concentration is zero. Next, suppose $\eta\left(\rho_{FB}\right) > 0$. Evaluating $dW/d\alpha$ at $\alpha = 0$ and $\alpha = 1$ yields

$$\left.\frac{dW}{d\alpha}\right|_{\alpha=0} = \eta\left(\rho_{FB}\right)\frac{dm^*}{d\alpha} > 0,$$

and

$$\left.\frac{dW}{d\alpha}\right|_{\alpha=1} = \left[\eta\left(\rho_0\right) - \Delta_S\right]\frac{dm^*}{d\alpha} = \left[\pi_S^*\left(\rho_0\right) - \pi_{FB}\right]\left(1+\rho_0\right)D\frac{dm^*}{d\alpha} < 0.$$

Thus, the optimal ownership concentration lies strictly between 0 and 1 and satisfies

$$\eta\left(\rho_0\right) - c'\left(m^*\right) = 0.$$

Uniqueness follows from (19). Q.E.D.

Proof of Proposition 5: Consider the large shareholder's first-order condition (2) and the creditor's zero profit condition (4) at $\rho = \rho_0$. Totally differentiating both equations, taking D, m^*, and ρ as variables, we obtain

$$D\left(1+\rho_0\right)\left[\underline{\pi} - \pi_{FB}\right]dm^* + D\left[m^*\underline{\pi} + \left(1-m^*\right)\pi_{FB}\right]d\rho_0 = 0,$$

and

$$-c''\left(m^*\right)dm^* + \alpha D\left[\pi_{FB} - \underline{\pi}\right]d\rho_0 = \alpha\left(1+\rho_0\right)\left[\underline{\pi} - \pi_{FB}\right]dD.$$

Applying Cramer's rule, we have

$$\frac{dm^*}{dD} = \frac{\alpha\left[\pi_{FB} - \underline{\pi}\right]D\left(1+\rho_0\right)\left[m^*\underline{\pi} + \left(1-m^*\right)\pi_{FB}\right]}{\Psi},$$

and

$$\frac{d\rho_0}{dD} = \frac{\alpha D\left(1+\rho_0\right)^2\left[\pi_{FB} - \underline{\pi}\right]^2}{\Psi} = \left[\frac{\left(1+\rho_0\right)\left[\pi_{FB} - \underline{\pi}\right]}{m^*\underline{\pi} + \left(1-m^*\right)\pi_{FB}}\right]\frac{dm^*}{dD}, \tag{20}$$

where $\Psi > 0$ is defined in (14). Hence, $dm^*/dD > 0$ and $d\rho_0/dD \geq 0$. Differentiating total shareholder wealth (6) with respect to D, we have

$$\begin{aligned}\frac{dW}{dD} &= \left[\Delta - c'\left(m^*\right)\right]\frac{dm^*}{dD} - D\left[m^*\underline{\pi} + \left(1-m^*\right)\pi_{FB}\right]\frac{d\rho_0}{dD} \\ &= \left[\omega - c'\left(m^*\right)\right]\frac{dm^*}{dD},\end{aligned}$$

where the second equality follows from inserting (20) and the definition of ω. From the previous analysis, we know that the optimal ownership concentration is below the optimal level if $\omega - c'(m^*) > 0$, and above the optimal level if $\omega - c'(m^*) < 0$, which proves the claim. Q.E.D.

Proof of Proposition 6: First, observe that $W_E(\alpha, i)$ is continuous in both α and i, and that $W(\alpha)$ is continuous in α. Moreover, in the proof of Proposition 1, it is shown that $\omega \leq 0$ implies $dW/d\alpha < 0$ for all $\alpha > 0$. Differentiating $W_E(\alpha, i)$ with respect to α and i, we obtain

$$\frac{dW_E(\alpha, i)}{d\alpha} = (1-\alpha)\frac{[\pi_{FB} r(\pi_{FB}) b]^2}{c''(m_E^*)} > 0,$$

for all $\alpha < 1$, and

$$\begin{aligned}\frac{dW_E(\alpha, i)}{di} &= \pi_{FB}(1+\tau(\pi_{FB}))[m_E^* + (1-m_E^*)(1-b)] \\ &\quad + [\pi_{FB} r(\pi_{FB}) b - c'(m_E^*)]\frac{dm_E^*}{di} - 1,\end{aligned} \tag{21}$$

where

$$\frac{dm_E^*}{di} = \frac{\pi_{FB}\alpha(1+\tau(\pi_{FB}))b}{c''(m_E^*)} \geq 0.$$

Inserting (10) in (21) shows that $dW_E(\alpha, i)/di > 0$ for all α. Evaluating $W_E(\alpha, L)$ and $W(\alpha)$ at $\alpha = 0$ gives

$$W_E(0, L) = \pi_{FB} r(\pi_{FB})(1-b),$$

and

$$\begin{aligned}W(0) &= \pi_{FB} R(\pi_{FB})(1-b) - D \\ &= W_E(0, L) + \pi_{FB} D(1+\tau(\pi_{FB}))(1-b) - D,\end{aligned}$$

which shows that $W(0) - W_E(0, L) > 0$. Consider now the two cases in the proposition.

Case 1. If $\kappa \leq 0$, the fact that $W(0) - W_E(0, L) > 0$, $dW/d\alpha < 0$ for all $\alpha > 0$, and $dW_E(\alpha, L)/d\alpha > 0$ for all $\alpha < 1$, implies that $W(\alpha) \geq W_E(\alpha, L)$ for all α. Additionally, as $W_E(\alpha, i)$ is strictly increasing in i, this also implies that $W(\alpha) \geq W_E(\alpha, i)$ for all $i \leq L$.

Case 2. If $\kappa > 0$, the fact that $W(0) - W_E(0, L) > 0$, $dW/d\alpha < 0$ for all $\alpha > 0$, and $dW_E(\alpha, L)/d\alpha > 0$ for all $\alpha < 1$, implies that there exists a unique threshold $\overline{\alpha} \in (0, 1)$ such that $W(\alpha) \geq W_E(\alpha, L)$ for all $\alpha \leq \overline{\alpha}$, and $W_E(\alpha, L) > W(\alpha)$ for all $\alpha > \overline{\alpha}$. Moreover, since $dW_E(\alpha, i)/di > 0$, this also implies that $W(\alpha) \geq W_E(\alpha, i)$ for all $\alpha \leq \overline{\alpha}$ and $i \leq L$. Next, note that if $i = 0$, we have $W_E(\alpha, i) = 0 < W(\alpha)$ for all α. From $dW_E(\alpha, i)/di > 0$, it then follows that for all $\alpha \in (\overline{\alpha}, 1]$, there exists a unique threshold $\overline{i}(\alpha) \in (0, L)$ such that $W_E(\alpha, i) > W(\alpha)$ if $i > \overline{i}(\alpha)$, $W_E(\alpha, i) = W(\alpha)$ if $i = \overline{i}(\alpha)$, and $W_E(\alpha, i) < W(\alpha)$ if $i < \overline{i}(\alpha)$.

To show that $\overline{i}(\alpha)$ is strictly decreasing in α, we argue to a contradiction. Suppose $\overline{i}(\alpha_1) \leq \overline{i}(\alpha_2)$ for any two values $\alpha_1, \alpha_2 > \overline{\alpha}$ such that $\alpha_1 < \alpha_2$. From the definition of $\overline{i}(\alpha)$, it follows that $W_E(\alpha_1, \overline{i}(\alpha_1)) = W(\alpha_1)$ and $W_E(\alpha_2, \overline{i}(\alpha_2)) = W(\alpha_2)$. As $dW_E(\alpha, i)/d\alpha > 0$ for all $\alpha < 1$ and for all i, and $dW_E(\alpha, i)/di > 0$ for given α, it must be true that

$$W(\alpha_2) = W_E(\alpha_2, \overline{i}(\alpha_2)) \geq W_E(\alpha_2, \overline{i}(\alpha_1)) > W_E(\alpha_1, \overline{i}(\alpha_1)) = W(\alpha_1),$$

contradicting the fact that $W(\alpha)$ is strictly decreasing for all $\alpha > 0$. Q.E.D.

Proof of Proposition 7: If the creditor retains control, the equilibrium interest rate is ρ_0^B. The (gross) equity value is then

$$E_C = m_C^* \overline{\pi} \left[R\left(\overline{\pi}\right)(1-b_C) - D(1+\rho_0^B) \right] + (1-m_C^*)\pi_{FB} \left[R\left(\pi_{FB}\right)(1-b) - D(1+\rho_0^B) \right].$$

If the large shareholder deviates and withdraws his control rights, the equity value is

$$E_S(\alpha) = m^* \underline{\pi} \left[R\left(\underline{\pi}\right) - D(1+\rho_0^B) \right] + (1-m^*)\pi_{FB} \left[R\left(\pi_{FB}\right)(1-b) - D(1+\rho_0^B) \right].$$

Accordingly, the large shareholder's payoffs from deviating and not deviating are $V_S(\alpha) = \alpha E_S(\alpha) - c(m^*)$ and $V_C = \alpha E_C$, respectively. Define $\zeta\left(\alpha\right) = V_S(\alpha) - V_C$. By optimality, the large shareholder deviates if and only if $\zeta\left(\alpha\right) > 0$. From the envelope theorem, it follows that

$$\frac{d\zeta\left(\alpha\right)}{d\alpha} = E_S(\alpha) - E_C.$$

Moreover,

$$\frac{d^2\zeta\left(\alpha\right)}{d\alpha^2} = \frac{\partial m^*}{\partial \alpha} \Delta\left(\rho_0^B\right) > 0. \tag{22}$$

Evaluating $d\zeta\left(\alpha\right)/d\alpha$ at $\alpha = 0$ gives

$$\left. \frac{d\zeta\left(\alpha\right)}{d\alpha} \right|_{\alpha=0} = -m_C^* \varphi, \tag{23}$$

where $m_C^* > 0$ by (11). Together, (22), (23), and the fact that $\zeta\left(0\right) = 0$ imply cases i)-iii). Q.E.D.

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