The Interaction of Capital Structure and Ownership Structure

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This Version: May 2000

* I thank Denis Gromb, Julian Franks, David Scharfstein, and Jeremy Stein for many insightful comments. I have also benefited from conversations with Micael Castanheira, Michele Habib, Jennifer Huang, Arvind Krishnamurthy, Robert Marquez, Stewart Myers, Eric Powers, Michael Salinger, Henri Servaes, Raman Uppal, and seminar participants at M.I.T., Boston University, University of Utah, Arizona State University, Indiana University, Cornell, CEMFI, London Business School, Stockholm School of Economics and SITE, Norwegian School of Management, University of Amsterdam and the University of Pittsburgh. All remaining errors are my own.
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Abstract:
This paper develops a model in which the interaction of the capital structure and the ownership structure of a manager-run firm can be analyzed. Multiple securities arise as optimal in the model. This allows for a meaningful analysis of interaction effects between various aspects of the capital and ownership structure, in particular interactions between features of debt and equity. Empirical implications are derived for the interaction of equity ownership dispersion, debt ownership structures, bank debt (subject to covenants) and dispersed public debt, board representation of large investors, and features of the institutional environment (such as the bankruptcy law). There is also a predicted (positive) relationship between the need to induce managers to invest for the long term and the extent to which equity should be dispersed. In addition, the paper predicts that the ability of debt holders to control managerial self-interest may be a complement to (and not a substitute for) the ability of equity holders to control managerial self-interest. Finally, the paper demonstrates that the capital and ownership structures are useful for providing incentives for both managers and investors, even if monetary incentive schemes (salaries, bonuses, etc.) are optimally designed.

JEL classification: G30, G32
Keywords: Ownership Structure, Corporate Control, Capital Structure.
1. Introduction

There is a growing consensus among academics and practitioners that the ownership patterns of financial securities have a significant impact on the efficient running of large corporations. Economists\(^1\) and legal scholars\(^2\) have examined the effect that large shareholders have on firm behavior. Others have analyzed the role of large lenders as well as small, dispersed owners of debt securities.\(^3\) Among practitioners, the *Wall Street Journal* (1995) has examined the role played by significant individual shareholders, while the *Institutional Investor* (1985) is one example of a discussion on the role of financial institutions. In addition, there exists a long literature and debate on the optimal capital structure.

This paper models *jointly* the capital structure of manager-run firms *and* the ownership patterns of the financial securities among small and large investors. The main benefit of this specification is that it results endogenously in an (optimal) multiplicity of securities, which allows for a meaningful analysis of interaction effects. There are many aspects of the financial structure that interact: the dispersion of a particular class of claims, the shape of their return rights, the presence of covenants and restrictions, the representation of particular classes of securities on the corporate board, etc.

Understanding these interactions is the main contribution of the paper.

The empirical predictions include the following: (i) strong, concentrated equity ownership is associated with strong, concentrated debt holdings in the model. Similarly, weak dispersed equity and debt holdings tend to coexist. This may be interpreted as being consistent with the stylized differences between German/Japanese structures and US/UK structures. With respect to empirical analyses, we might expect that in the data, the powers of debt and equity to monitor and control management\(^4\) are not substitutes

\(^1\) e.g. Smith (1996), Shleifer and Vishny (1986), Burkart, et al. (1997) and Maug (1998).
\(^2\) e.g. Black (1992a,1992b).
\(^3\) e.g. Bolton and Scharfstein (1996).
\(^4\) As measured by (say) the number of debt covenants, board representation, dispersion of claims, etc.
but complements. (ii) If long term firm specific investments (say in project development and discovery) by management are relatively more important than individual project selection, then equity should be more dispersed (for a given debt structure).\(^5\) (iii) Board representation by banks is desirable, especially if equity ownership is concentrated (see Kroszner and Strahan (1999) for evidence along these lines).\(^6\) (iv) Environments with weak (tough) bankruptcy procedures may be associated with relatively dispersed (concentrated) equity ownership patterns. (v) Tough debt covenants may be more prevalent in environments that also favor large equity holders. Finally, the model implies that any empirical analysis of the relationship between equity ownership concentration and firm performance may have little explanatory power, unless it also includes the effects of the firm’s capital structure.

The implications of the paper derive from the following intuition: if a firm is owned by multiple sets of investors (say debt and equity investors), and these sets of investors have differential abilities/costs of interfering with management choices, then managers will have a preference as to which of these investors should have the legal right to determine the course of the firm. Hence, managers can be motivated to ‘do the right thing’ (e.g. make investments in effort, firm specific human capital, etc. - especially long term investments such as looking for and developing new projects) by a contractual setup which leaves the managers' preferred investors in charge only if the managers perform well.

The dispersion of securities, monitoring costs, board representation, covenants, the institutional environment (such as bankruptcy law), etc. all affect the relative powers of different classes of investors - and hence determine how much managers prefer one class to the other. If these classes are interpreted as debt holders and equity holders, then

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\(^5\) This complements previous thoughts on stock market induced myopia (e.g. Stein (1989)), which did not consider the issue of share dispersion.

\(^6\) Interestingly, while board membership by banks is very common in Germany and Japan, there are also bankers on boards in over 30% of large US firms.
managers are motivated by the *difference* between the relative toughness of debt holders and the relative weakness of equity holders. Of course, having dispersed (weak) equity holders also comes at a cost - managers may now abuse their powers and divert resources. Thus, there is an optimal balance between having debt be much tougher than equity (to motivate managers to work hard and make long term investments to keep equity in control) on the one hand, and having equity be not too weak in order to keep the managers from diverting too many resources to themselves.

An example of the mechanism and its empirical implications would be the following: imagine a firm where debt is concentrated (and hence quite tough). Equity on the other hand is dispersed (and hence quite weak). 7 Consequently, equity control allows the manager some limited freedom to divert some resources. On the other hand, maximizing the long-term cashflows to investors increases the probability of (weak) equity remaining in control. Under the optimal contract, the benefits of the manager maximizing long-term firm cashflows outweigh the costs of allowing the manager some freedom to divert some resources. Now imagine that the bankruptcy laws become much stronger in favor of the debt holders (say we are now looking at UK firms rather than US firms). This makes debt control much less appealing the manager. In this case, equity does not have to be quite so dispersed in order to look appealing to the manager. Hence, equity can be much more tough and concentrated and still equity control (which the manager thinks of as *reward*) will look *relatively* attractive to the manager, because debt control (which the manager thinks of as *punishment*) looks so undesirable. In other words, the manager will be motivated to act in the long-term interests of investors (to keep equity in control) even if equity control is tough and concentrated. Consequently, the optimal contracts arising under different regimes predict an empirical association of more concentrated equity with bankruptcy laws which are more creditor friendly (ceteris paribus, of course).

Note that the securities described in this paper are *optimal contracts* to deal with

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7 The relationship between ownership dispersion and *toughness* is discussed below.
the incentives of both managers and investors. In other words, the model provides a rationale for why firms’ financial structures are the way they are. There may be, however, other reasons for firms to issue certain claims in certain quantities (e.g. taxes) and for investors to hold them in certain quantities (e.g. diversification). Nevertheless, the interaction effects discussed below will still be empirically valid even if some of the reasons for issuing and holding claims are outside the model.

The current paper also shows that carefully designed monetary incentive schemes (e.g. bonuses and equity participation) do not remove the need for the provision of incentives via the capital and ownership structures.

Early models in this area\(^8\) have often analyzed the capital structure with respect to the incentives it provides for the manager, without assigning an active role to the outside investors. The result was that the claims that should be held by an entrepreneur-manager were clearly determined, while the exact nature of the claims held by the outside investors was indeterminate. In other words, nothing prevented outside investors from carving up the aggregate claim they are assigned,\(^9\) into as many different claims as suits their needs. Several recent contributions\(^10\) have explicitly assigned an active role to outside investors and thus removed the indeterminacy of the nature of their claims. It is this idea that is examined further in the current paper.

One useful application of the model may be an analysis of the initial allocation of financial securities in an IPO. Brennan and Franks (1997) examine the mechanisms that are used in the UK to ensure that, following an IPO, the presence of large outside shareholders is limited. Stoughton and Zechner (1998), on the other hand, examine how the IPO process actually encourages the creation of outside ownership blocks. In particular, they show the importance of regulatory constraints in influencing the

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\(^9\) This aggregate claim often resembled standard debt, leaving the entrepreneur-manager with levered equity as the optimal incentive contract.

\(^10\) See the literature review below.
mechanisms of block creation.\textsuperscript{11} The present paper may offer additional considerations in terms of the firm’s capital structure and its institutional environment (e.g. bankruptcy procedures, the ability of investors to monitor, etc.) that can lead to further analyses of the IPO offering phenomena. In particular, both costs and benefits of block holdings are examined and related to other aspects of the firm’s capital structure and environment.

The remainder of the paper is organized as follows: after a very brief literature review, section 3 will introduce the basic model. Section 4 discusses the implementation of the optimal incentive contract utilizing the capital and ownership structures of the firm. Section 5 examines the implications of the model. The introduction of monetary incentives as an alternative is considered in section 6. Section 7 concludes.

2. Related Literature

This paper extends a growing literature on multiple securities in the outside capital structure. Contributions which focus on different debt contracts include Diamond (1984,1991,1993), Berglöf and v. Thadden (1994), Rajan and Winton (1995) and Bolton and Scharfstein (1996). Contributions that focus on equity include Shleifer and Vishny (1986) on monitoring by large shareholders and Burkart, Gromb and Panunzi (1997) on equity dispersion.\textsuperscript{12} The coexistence of debt and equity is the focus of Dewatripont and Tirole (1994),\textsuperscript{13} Habib and Johnsen (1999) and Boot and Thakor (1993). Excellent surveys of capital structure and security design have been produced by Harris and Raviv (1991,1992) and Allen and Winton (1992).

The papers closest in spirit to the present discussion are Dewatripont and Tirole (1994), Burkart, Gromb and Panunzi (1997) and Aghion and Bolton (1992).

Dewatripont and Tirole discuss the effect of assigning control rights to multiple outside investors. While their focus on the interaction of cashflow rights and control

\textsuperscript{11} A related paper with different assumptions is Mello and Parsons (1998).
\textsuperscript{12} Other papers in this area are Myers (2000) and Acemoglu (1995).
\textsuperscript{13} A related paper is Berkovitch and Israel (1996).
rights provides important new insights, they do not address the ownership implications (dispersion versus concentration), institutional predictions (e.g. the effect of bankruptcy procedures on equity ownership), or implications for monitoring or board representation.

Burkart, et al. demonstrate the connection between managerial discretion and monitoring by outside equity holders as well as the consequences of equity dispersion for managerial incentives. However, they cannot model the consequences for the firm’s capital structure or many of the features of debt discussed below. Aghion and Bolton show that a contingent allocation of control rights can lead to improved decisions by managers. However, there are no ownership structure considerations, monitoring, or institutional effects in their model.

The idea of effective control, which is central to this paper, has been discussed by Aghion and Tirole (1997), who propose a difference between real and formal authority (effective control and [legal] control rights in the current paper) in organizations.\(^\text{14}\) In their model, economic agents who have formal authority may not have any real authority, because their incentives to exercise their formal authority are reduced (say by an informational disadvantage). However, Aghion and Tirole do not analyze the financing problem of a firm run by a manager as an agent for investors.\(^\text{15}\)

The current paper is set in an incomplete contracting environment, in which the allocation of control rights assures that all parties make relationship specific investments. The analysis is based on ideas of Grossman and Hart (1986) and Hart and Moore (1990).

### 3. The Model

This section discusses the set-up of the model and the solution to incentive problems via a (somewhat abstract) optimal contract. The interpretation of the optimal

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\(^{14}\) Early work in this area was done by Berle and Means (1932), who examine the limits to the real powers of equity holders who hold all legal rights to make decisions.

\(^{15}\) Crémer (1995) independently discusses the relationship between effective control and information.
contract in terms of the firm’s capital and ownership structure is postponed until the next section.

3.1. Set-up

All parties are risk neutral. There are three dates, $t \in \{0, 1, 2\}$. There will be a managerial 'effort' choice as well as a subsequent project selection.

At $t = 0$ investors need a manager to run a firm they own. The firm is assumed to have positive NPV. Contracts between the investors and the manager are signed. The manager makes a firm-specific investment (e.g. in human capital, project discovery and development, or effort$^{17}$) $e \in \{e_l, e_h\}$ where she incurs a cost $k$ for $e_h$ and no cost otherwise. The level of $e$ is non-contractible. The manager has no wealth and does not respond to monetary incentive schemes such as bonuses. (This assumption simplifies the exposition. It is removed in section 6 without altering the results.)

At $t = 1$, the first cashflow $c^l(e) \in \{c_l, c_h\}$ is realized, where $0 \leq c_l < c_h$. This cashflow is contractible. High managerial effort increases the probability of high cashflows: $\text{Prob}(c_h|e_h) = p > 0$ and $\text{Prob}(c_h|e_l) = 0$. After having observed $c^l$, a non-contractible project or course of action $\gamma$ has to be chosen from a set $\Gamma$. The manager proposes a course of action, but the party which has the legal right to make decisions for the firm can overrule the manager.

At $t = 2$ the final cashflow $\tilde{c}^2(\gamma e) \geq 0$ is realized and the manager receives non-contractible private benefits $B(\gamma) \geq 0$. For simplicity, assume that $\tilde{c}^2(\gamma e) = \hat{c}^2(\gamma) + \kappa$ if the manager chose $e_h$, and $\tilde{c}^2(\gamma e) = \hat{c}^2(\gamma)$ if the manager chose $e_l$ ($\kappa$ is a positive constant). The second period cashflow $\tilde{c}^2(\gamma e)$ is again contractible.

The model is summarized in the figure below.

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16 Most results stay unchanged when the manager initially owns the firm. See also footnote 24.
17 The “effort” choice is to be understood as a metaphor for any moral hazard problem that affects the long-term profitability of the firm. Thus, if corporate restructuring and large-scale layoffs or the implementation of a moderate-growth business strategy are less desirable to the manager than other alternatives, then this moral hazard set-up would capture the effects of managerial self-interest.
18 Private managerial benefits could arise from perquisite consumption, diverted cash flows, the realization of empire building desires, increased value of personal human capital arising from certain projects (say starting a prominent internet commerce division) etc.
A couple of comments are in order: first, the second period cashflows are increasing in $e$. Hence, the manager’s investment in $e$ can be interpreted as an investment in the long term profitability of the firm. One might imagine that there are simply more profitable projects available to the firm if the manager chooses $e_h$ at $t = 0$.\textsuperscript{19} Second, since $\hat{c}^2(\gamma e)$ is contractible and $\gamma$ is assumed not, it is best to think of $\hat{c}^2(\gamma)$ as a random quantity. Thus, it is not possible to infer perfectly which $\gamma$ had been chosen at $t = 1$ just by looking at the realization of $\hat{c}^2(\gamma e)$. Denote the expectation of $\hat{c}^2(\gamma)$ as $c^2(\gamma)$.

Finally, ‘contractible’ means that courts can observe outcomes and choices and will enforce contracts that include them. Non-contractible choices may still be observable to managers and investors, but contracts cannot be written on them. This is

\textsuperscript{19}The choice of $e = e_h$ at $t = 0$ has the flavor of a long term investment, because it leads to some benefits for the firm at $t = 2$ which are independent of the individual project chosen at $t = 1$. 
because, at \( t = 0 \), it is impossible to specify exactly what course of action to choose at \( t = 1 \), in a manner that can be enforced by a court of law. Hart (1995) discusses this specification at length. In some sense, the inability to lay out all future courses of action in a contract is the very reason that firms are run by managers and not automatons.

### 3.2. Control Rights and the Cost of Collective Action - \( \alpha \)

As the project decision \( \gamma \) cannot be contractually specified ex ante, the control rights of the firm matter and must be specified. The party with the control rights has the legally enforceable right to make decisions whenever contracts do not specify what to do. Control rights are contractually assigned to either (a subset of) the investors or the manager. The assignment of control rights can depend on all contractible variables in the model - in particular it can depend on the realization of the first period cashflow.\(^{20}\)

In the spirit of Hart (1995) and Aghion and Bolton (1992), we recognize that the allocation of control rights provides important incentives for all players. In essence, having control rights protects all rents which are generated by previous investments. However, we will join Aghion and Tirole (1997) in departing from the assumption that the allocation of control is an all-or-nothing decision. While the legal right to make decisions is generally assigned to one party or the other, there are several reasons why a party may choose not to exercise this right (leaving effective control with the other party). In particular, if a party (say a subset of the investors) has the right to make a decision, but this party faces a cost in implementing this decision, then it may defer to another party (say management) to make the decision instead. The most obvious reason would be that the party with the control rights is less well informed, and hence it will defer its decision making power to the more informed party in order to avoid making mistakes which hurt both parties.

The main feature of financial contracts which determines the allocation of effective control is the ownership dispersion of the financial contracts (other aspects,\(^{20}\)

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\(^{20}\) For example, debt contracts may assign control rights to outside lenders if the firm realizes low cashflows and cannot pay interest.
such as covenants, the legal and institutional environment, and more, are discussed below). Hence, we can think of the contractual claims on the firm to have two features: first, they assign monetary returns and legal control rights, and secondly, they exhibit a certain level of dispersion/concentration.

The particular mechanism through which the dispersion of contracts enters the model is by inducing a cost of collective action (denoted as $\alpha$). Several authors have argued elegantly (see among others Berle and Means (1932), Grossman and Hart (1980) and Burkart, et al. (1997)) that dispersed owners have difficulties in taking actions which maximize firm value, but are not in the interests of incumbent management. There are two related reasons why groups of investors face a cost of collective action when they are dispersed. First, small claim holders will free ride on the efforts of the large claim holder(s) whenever there is a small fixed cost of taking actions. Second, the large claim holder(s) will take privately costly actions (e.g. monitoring) only to the extent that these actions protect their own interests. Hence, there is an externality in that the large claim holder(s) will not take into account the beneficial effects of their action on the small claim holders.\textsuperscript{21}

As a consequence, whenever shareholdings or debt holdings are dispersed, the investors face a cost $\alpha$ of overruling management.\textsuperscript{22} This cost will enable the manager to retain some effective control over decisions, as the manager can implement preferred projects as long as the cost of overruling these is too large for investors (compared to the benefits of overruling the manager). Hence, there is a distinct wedge between the legal right to make decisions (which may rest with investors) and the effective locus of control (which often rests with management). This wedge is proportional to $\alpha$. It is important to realize that, while it may appear that investors would always want $\alpha$ to be as small as possible, the manager will only have incentives to create rents if she knows that investors cannot expropriate all of these rents. Hence, some positive level of $\alpha$ may

\textsuperscript{21} Thinking of dispersion as inducing a moderate level of coordination failure is perfectly appropriate.
\textsuperscript{22} There is no presumption that equity dispersion has quantitatively the same effect as debt dispersion.
just leave the manager with enough effective control in order to want to create rents through firm-specific investments. This point, made elegantly by Burkart, et al. (1997), is discussed more below and leads to some interesting effects in terms of the capital and ownership structure.

A formal model of the cost $\alpha$ is presented in the appendix.\footnote{The model is relegated to the appendix, because it is a modified version of the model in Burkart et al. (1997), adapted to fit the current setup, and this paper has no new insights on that particular issue.}

For now, it suffices to think of $\alpha$ as a reduced-form result from having the investors’ claims dispersed among many individuals. As the model in the appendix shows, this cost of collective action is increasing in the level of dispersion among claim holders, increasing in the investors’ cost of monitoring, and increasing in the informational disadvantage of the investors relative to the manager. Other features that affect $\alpha$, such as debt covenants, return rights and board representation are discussed in the coming sections.

Formally, the optimal contract will specify the assignment of control rights to various parties. Associated with each group that may receive the control rights is a (group specific!) cost of collective action $\alpha$, which will directly depend on the capital structure and ownership dispersion chosen by the firm.

**Assumption 1:** Any subset $i$ of investors that may be assigned control rights faces a cost of collective action $\alpha_i \geq 0$ when it wants to overrule a project choice suggested by the manager.

The *optimal* ownership structure of a firm will derive from the desired *optimal* choice of $\alpha$.

### 3.3. The Optimal Contract

The initial focus will be on the allocation of control via the optimal contracts and
not on the shape of the return rights. Hence, investors are assumed to maximize the expected value of cashflows (as if they had linear return rights). Section 5.4. will examine the issue of non-linear return rights in the context of the present model.

The following assumptions are also needed:

**Assumption 2:**

(i) *High effort is desirable.*

(ii) *The functions \( B(\cdot) \) and \( c^2(\cdot) \) are sufficiently smooth and the set \( \Gamma \) is sufficiently rich to ensure that optima exist.*

The following proposition describes the optimal contract between the manager and the investors under the current set of assumptions. The implementation of the contract via the firm’s capital structure is postponed until the next section. The contract specifies two things: the assignment of control rights to two different subsets of investors, and the subset-specific levels of \( \alpha \) that leads to the optimal project choices.

**Proposition 1:** The contract between the manager and investors that maximizes the return to the investors\(^{24}\) is the following: (i) all cashflows accrue to the investors, (ii) the control rights rest with two different subsets of investors, group \( h \) and group \( l \), where group \( h \) (group \( l \)) has the control rights following \( c_h \) (\( c_l \)), and

\[
(\alpha_h^*, \alpha_l^*) = \arg \max_{(\alpha_h, \alpha_l)} \left\{ p \left[ c_h + c^2(\gamma_{\alpha_h}) + \kappa \right] + (1-p) \left[ c_l + c^2(\gamma_{\alpha_l}) + \kappa \right] \right\}
\]

s.t. \( B(\gamma_{\alpha_h}) - B(\gamma_{\alpha_l}) > \frac{k}{p} \),

where \( \gamma \equiv \arg \max_{\gamma} \{B(\gamma)\} \) s.t. \( c^2(\gamma^*) - c^2(\gamma) \leq \alpha \)

\(^{24}\) If the firm is initially owned by the manager, then she would clearly prefer an arrangement that maximizes her utility rather than the cashflow to investors. As long as the investors can compensate the manager for any expected reduction in future private benefits, they will come to an arrangement that is efficient. The contract that arises in this situation is qualitatively identical to the one derived in this paper.
\[ \gamma^* = \arg \max_{\gamma} \{c^2(\gamma)\} \]

Furthermore,

1) \[ \alpha^*_h \geq \alpha^*_i \]

2) \[ \alpha^*_i = 0 \text{ is always optimal (though not necessarily unique).} \]

**Proof:** See Appendix.

This proposition formalizes the following intuition: After indications of good performance by the manager (\( c^J = c_h \) indicates that the manager chose \( e = e_h \)), the manager is given some effective control. This effective control arises from the fact that investors may allow *some* decisions of a self-serving manager stand, because they face a cost \( \alpha_h > 0 \) of overruling her.\(^{25,26}\) This effective control is not given following bad firm performance. Consequently, the manager has incentives to work hard in order to ensure that firm performance is high. Another way to look at the solution is to say that the effective control given to the manager at \( t = 1 \) protects some of the rents generated by the manager, and this motivates the manager to create the rents at \( t = 0 \).

4. Capital Structure

In this section, it is shown how the optimal contract discussed in proposition 1 can be implemented using standard debt and equity securities. In section 6 it is shown that monetary incentive schemes (salary and bonus) would not eliminate the need for a carefully designed capital and ownership structure.

First, some basic features of standard debt and equity securities are defined for the purposes of the current discussion:

\(^{25}\) Clearly, this effective control is limited. If the manager proposes projects which likely lead to terrible results, investors will overrule her and face up to the cost-of-collective action rather than letting the manager go ahead.

\(^{26}\) It appears that there is sufficient anecdotal evidence that managers indeed value this effective control quite highly.
“Debt” is a security that is entitled to a payment $D_t$ at time $t$. Debt holders receive the control rights over the firm if a payment is not made. Unless all debt holders agree to do otherwise, project choice $L \in \Gamma$ is implemented when any one class of debt is in default. ²⁷ If a class of debt is “senior,” it is entitled to receive all of its face value before other classes of debt. ²⁸

“Equity” is a security that has the control rights unless they rest with debt holders. Equity holders receive all residual cashflows.

Debt and dispersed equity can implement the optimal incentive contract in proposition 1 as follows: the firm issues long-term, coupon bearing debt (due at $t = 2$). The required coupon payments are high enough to cause the firm to default in the low cashflow state (but not in the high cashflow state), ²⁹ shifting the control rights to the debt holders who are not subject to any cost of collective action ($\alpha^*_D = 0$). Furthermore, the face value of the long term debt is high enough that the manager cannot raise new funds sufficient to avoid debt control in the low state. The firm also issues equity that is dispersed among many shareholders. The (optimal level of) dispersion induces a cost of collective action $\alpha^*_E$ that is incurred whenever the shareholders want to challenge a decision by the manager. ³⁰

**Proposition 2:** The optimal incentive scheme between the manager and investors can be implemented by (i) long term debt with coupon payment $D_1 \in (c_l, c_h)$ and face value $D_2$.

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²⁷ This simply establishes the outside option for debt holders should there be more than one debt holder and not all of them have perfectly congruent interests. The choice of $L$ is without loss of generality, as the parameter set $\Gamma$ is still not ordered - $L$ could be anything (including liquidation). The requirement of unanimity among debt holders is used both for realism (US law provides for this specification) and tractability. One could imagine instead a more complicated model, in which different classes of debt holders play a game during default, the expected outcome of which provides ex ante incentives for management.

²⁸ Violations of absolute priority can easily be accommodated.

²⁹ Alternatively, there could be some amount of short-term debt due at $t = 1$.

³⁰ Note also that renegotiation of the contracts at $t = 1$ is not a problem, because investors will face the same cost of collective action $\alpha$, whether they want to challenge managerial project choice or completely rearrange the firm’s capital and ownership structure via renegotiation.
\[ c^2(\gamma^*) + \kappa - (D_1 - c) \], not subject to any cost of collective action \((\alpha_D = 0)\), which is senior to any new security that can be issued at \(t = 1\); (ii) dispersed equity which is subject to a cost of collective action \(\alpha^*_E\) such that:

\[
\alpha^*_E = \arg \max_a \left\{ p \left[ c_h + c^2(\gamma_a) + \kappa \right] + (1-p) \left[ c_I + c^2(\gamma^*) + \kappa \right] \right\} \text{ s.t. } B(\gamma_a) - B(\gamma^*) \geq \frac{k}{p} \tag{2}
\]

**Proof:** See Appendix.

The optimal capital structure can be put in place in multiple ways: first, it could be implemented at the time when the firm goes public. The leverage choice would be up to the entrepreneur-manager (who maximizes private benefits plus cashflows to arrive at the optimal contract). The optimal level of ownership dispersion can be regulated by some mechanisms during the IPO phase (see Brennan and Franks (1997) and Stoughton and Zechner (1998)). The capital and ownership structure could also result later in a firm’s life from managerial choice (managers may not be able to raise new funds unless they implement the optimal capital structure) and market forces (if investors, all else equal, would hold diversified portfolios, then some investors would - over long time horizons - choose to become less diversified in order to commit to monitor the manager at the appropriate level and increase the value of the firm).

An important issue that arises is the question of the short-term stability of the ownership structure. Are dispersed shares going to stay dispersed? Are blocks stable? The model in this paper views the ownership structure as an integral part of the firm’s financial make-up. Hence, it would loose some of its effect if the concentration of blocks or the dispersion of shares changes significantly over very short periods of time.

From an empirical perspective, blocks are relatively stable and do not form over short periods of time except in unusual circumstances such as takeover battles. This is in line with the assumptions of this paper.

From a theoretical perspective, this paper predicts that the ownership structure can serve as an incentive device if shareholders can commit to some dispersion at \(t = 0\). It is
imperative that the manager know that it will not be the case that at $t = 1$ a controlling block can form costlessly, the owner of which is able to extract all the private benefits from the manager when it comes to a project choice (say the choice of agreeing to a takeover). Arguments along the line of those in Grossman and Hart (1980) make it clear that this is unlikely. With a significant level of initial dispersion, free-rider effects will make the formation of blocks to control the firm (over the objections of current management) difficult. As long as a (potential) large investor would have to share some of the rents generated by her actions with free riding small shareholders, the model stands and the ownership dispersion does act as a commitment device.

5. Implications

This section explores the implications of the model and examines the debt side of the optimal contract in detail. First, however, the equity side and its connection to long term investments is analyzed.

5.1. Long Term vs. Short Term Investments and Equity Dispersion

One of the implications of the model is that, given a particular debt structure, the optimal level of dispersion for equity shares depends on the nature of the agency problem in the firm. There are two distinct managerial moral hazard problems in the model - long term firm specific investments (say in project discovery and development) and short term project selection. Dispersion of equity shares is beneficial to one of the problems (long term investments), because it motivates the manager by protecting the rents she creates. However, dispersion is harmful to the other (project selection), because it leaves some freedom to the manager to choose non-optimal projects. Hence, firms should have more dispersed equity if long term firm specific investments are relatively more important than short term project choice. This may be of particular interest in examining the evolution of firms over their life cycle. Firms that need to invest for the long run (say growing pharmaceutical firms) may require more dispersed ownership (for a given debt structure). These same firms, when they have reached the
zenith of their development cycle and are mainly harvesting the rents of their previous investments through various projects, should have active large shareholders.

The following formalizes the above arguments: In the model of section 3, having investors subject to a cost of collective action $\alpha_h > 0$ (which is later implemented via dispersion of equity shares) enables the firm to satisfy the manager’s incentive compatibility constraint. This is only of value when the firm is better off following a choice of $e = e_h$ by the manager. Rather than imposing assumption 2 (namely that it is always beneficial to have the manager select $e = e_h$), the following proposition will establish under what circumstances $e = e_h$ is desirable. These are then the conditions under which the firm should have dispersed equity.

**Proposition 3:** *Ceteris Paribus, $\alpha_h > 0$ is part of the optimal contract if $\kappa$ is high.*

**Proof:** See appendix.

The proposition says that the higher the benefit $\kappa$ of long term investments to the firm, the more likely it is that dispersed equity will be part of the optimal contractual setup.

**5.2. Debt Powers**

Before some of the implications of the model for the debt structure are developed, it is necessary to comment on the optimal debt structure. According to propositions 1 and 2, it is desirable to ensure that debt holders face no cost of collective action ($\alpha_D = 0$). This would suggest that the optimal debt contract is (i) held by one individual or institution (say a bank), that (ii) this debt holder have information about the firm which is at least as good as the manager’s information, and that (iii) the bankruptcy laws entitle the debt holders to implement whatever action they prefer (without regard for other stakeholders). While (i) is plausible (although deviations from this will be discussed

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31 More precise conditions can be derived if the functional forms of $\tilde{z}(\gamma,e)$ and $B(\gamma)$ are specified.
briefly below\textsuperscript{32}, (ii) and (iii) might be impossible to attain. The manager may always have some informational advantage over debt holders, and the bankruptcy system might always leave some effective control with the manager.

In light of the above, the following definition will help to illuminate the optimal debt structure and its relationship with the equity side of the capital structure. For the remainder of the paper, the quantity $\alpha_D > 0$ is defined as the minimum cost of (collective) action faced by the debt holder(s). Hence, even though $\alpha_D$ should be as small as possible, it cannot be pushed below $\alpha_D$ for various institutional and informational reasons.

**Definition:** $\alpha_D \equiv \min \{ \alpha_D \}$

Note that this paper will not address the issue of why bankruptcy law does not convey full powers to lenders. Hence, it makes no attempt to justify why $\alpha_D$ is greater than zero. The paper simply illuminates some of the consequences of having $\alpha_D > 0$.

**5.3. The Complementarity of Debt and Equity Powers**

One novel implication of the model is that the ability of debt holders to control management is a complement to (and not a substitute for) the ability of equity holders to control management. In other words, if the power of debt holders increases (i.e. $\alpha_D$ becomes smaller), the *optimal* level of power for equity holders also increases (i.e. $\alpha^*_E$ also decreases).

The intuition for this result derives from the source of the manager’s incentives to ‘do the right thing’ (choosing efficient, but not privately desirable, strategies): the manager of the firm is motivated to make firm-specific investments (say in human capital or effort) by the desire to keep the control rights of the firm with outside equity (e.g. avoid bankruptcy). Only if equity control is more desirable for the manager than

\textsuperscript{32} See also Bolton and Scharfstein (1996) and Rajan (1992).
debt control will the manager have proper incentives. In other words, the manager is motivated by the difference in power of debt and equity holders. Consequently, if control by large debt holders following bankruptcy is very tough on management, i.e. $\alpha_D$ is low, then there will be correct incentives even when large equity holders are also somewhat tough on management, i.e. $\alpha_E$ is also low. Similarly, if debt holders are weak, then it better be that equity holders are even weaker, in order to preserve the manager’s incentive.

Formally, the model predicts a positive interaction between the toughness of debt and the dispersion of equity.

**Proposition 4:**

$$\frac{d\alpha_E^*}{d\alpha_D} \geq 0$$  \hspace{1cm} (3)

**Proof:** See Appendix.

A few empirical predictions follow immediately: (i) strong, concentrated equity ownership is associated with strong, concentrated debt holdings. Similarly, weak dispersed equity and debt holdings go together. This may be interpreted as being consistent with the stylized differences between German/Japanese structures and US/UK structures. La Porta, et al. (1997) provide some related evidence along these lines, albeit with some different interpretations. (ii) Environments with weak (tough) bankruptcy procedures (from the perspective of incumbent management) call for relatively weak (strong) equity ownership. Studies like La Porta, et al. (1997), Shleifer and Vishny (1997), and Franks and Sussman (1999) provide some related evidence in different contexts. It should be possible to extend these empirical analyses to formally test the ideas of the present paper.

Finally, while not providing conclusive evidence, some of the observations made by Berger, Ofek and Yermack (1997) are at least consistent with the hypothesis. Berger,
et al. observe that several proxies for the ability of shareholders to control management (e.g. large shareholder board presence) are positively correlated with firms’ debt levels.\textsuperscript{33} If the debt level is correlated with the power of debt holders in controlling management following poor cashflow realizations, or with the probability of debt holders attaining control, then these observations are consistent with the model.

5.4. Public vs. Private Debt, Covenants, Return Rights and Board Representation for Lenders

This section looks more closely at the structure of the optimal debt contract predicted by the model.

Bank Debt Covenants

Rajan and Winton (1995) show that the presence of debt covenants increases the monitoring activity of lenders by increasing the sensitivity of the lender's returns to information. In as much as monitoring is a hallmark of individual (i.e. bank) lenders, this section applies best to bank debt covenants. In the current model, this additional monitoring reduces the informational advantage that the manager has vis-à-vis the lenders (see the model of $\alpha$ in the appendix for the effect of the manager's informational advantage on $\alpha$) and hence reduces the effective control of the manager following $c_l = c_l$. This is beneficial in as much as it lowers $\alpha_D$ and thus increases the efficiency of project choices under debt control.

An important side-effect of lowering $\alpha_D$ through the presence of debt covenants is, that it now becomes feasible to decrease $\alpha_E^*$ without violating the manager’s incentive compatibility constraint. This follows directly from proposition 4.

Thus, bank debt covenants increase efficiency following $c_l = c_l$, but additionally they allow for a lower $\alpha_E^*$, ensuring more ex post efficiency even following $c_l = c_l$. Bank debt covenants are beneficial not only by encouraging the production of information used by debt holders to improve efficiency, but also by allowing the equity

\textsuperscript{33} Similar results obtain in Mehran (1992) and Friend and Lang (1988).
holders to keep a closer eye on management without negatively affecting managerial initiative. As an empirical matter, the correlation between restrictive covenants and equity dispersion could be examined. This paper predicts a negative correlation.

Return Rights

Up to this point, the analysis has concentrated on the allocation of control rights and effective control among investors. However, different (i.e. non-linear) return rights for different securities can serve to complement and amplify the previous results. Following Dewatripont and Tirole (1994), it will be shown that the return rights associated with the security that has control rights in the low cashflow state \( (c_l) \) should not necessarily be linear in cashflows. The assumption that will lead to the result is that the variance of \( c^2 \) depends on the choice of \( \gamma \).

Outside investors can use the concavity\(^{34} \) of the return rights of debt to provide credible incentives for the manager. If debt holders have control rights following \( c_h \), they would insist on a project (say \( \gamma_h \)) which may be different from the ex post efficient project \( \gamma' \). In particular, debt holders are more likely to insist on a low variance project choice. If the project \( \gamma_h \) is less desirable to the manager than \( \gamma^* \),\(^{35} \) then the manager will work especially hard to avoid the assignment of control rights to debt holders.

Of course, the contribution of this paper is that the concavity of the debt return rights also impacts the optimal level of equity dispersion. Using the concavity (which is related to the level of debt and the seniority) to commit to be tough on management in the low state, allows the investors to give the manager less flexibility (e.g. effective control) in the high state without destroying managerial initiative. Hence, less dispersed equity becomes optimal.

The following proposition summarizes the discussion:

\(^{34} \) The reason why concavity is more desirable for debt holders than convexity follows the arguments of Dewatripont and Tirole. In particular, concavity leads debt holders to choose low variance projects and these are less desirable to managers than projects that maximize expected cash flows, because low variance choices may correspond to asset sales, low growth business strategies, etc.

\(^{35} \) As argued convincingly in Dewatripont and Tirole.
**Proposition 5:** Making the return rights of the security with the control rights following \( c^l = c_l \) concave, increases expected cashflows if the concavity induces investors to insist on a “conservative” project choice \( \gamma_D \neq \gamma^* \) and

1. \( B(\gamma_D) < B(\gamma^*) \)

2. \( c^2(\gamma^*) - c^2(\gamma_D) < \frac{p}{1-p} \left[ c^2(\gamma_{\hat{a}_E}) - c^2(\gamma_{\hat{a}_l}) \right] \), where \( \alpha^*_E \) is defined as in proposition 2 and \( \alpha^*_E \) is the smallest value \( \alpha \) that solves

\[
pB(\gamma_{\hat{a}}) - B(\gamma_D) \geq k.
\]

**Proof:** See Appendix.

The proposition says that using the concavity of debt return rights is useful as long as (i) the manager perceives \( \gamma_D \), the choice that debt holders make after \( c_l \), as worse than \( \gamma^* \); and (ii) the ex post inefficiency from having debt holders implement their favorite project \( c^2(\gamma^*) - c^2(\gamma_D) \) is not too large relative to the expected gain from reducing the manager’s discretion \( c^2(\gamma_{\hat{a}_E}) - c^2(\gamma_{\hat{a}_l}) \) via less dispersed equity.

**Dispersed Debt**

Up until now, we have argued that concentrated claim holdings make investors strong, because they provide investors with better incentives to take privately costly actions such as monitoring. This was particularly important for debt holders, whose toughness motivates management. However, if monitoring is not terribly important (say we are dealing with large firms and accounting rules are reasonably transparent), there could be a different effect when it comes to public debt. Some authors have argued that dispersed public debt is subject to distortions when it comes to implementing the actions of debt holders in periods of financial distress (see e.g. Bolton and Scharfstein (1996)). This could lead to excessive liquidation (and/or other inefficient actions) following default. While ex post inefficient, the anticipation of these events could actually help to
further ex ante efficiency. The manager, anticipating liquidation after a low cashflow realization, may be extremely motivated to avoid this state.

Again, the contribution of the current paper is that this incentive effect on the debt side allows investors to reduce the amount of discretion that must be given to the manager on the equity side following a high cashflow realization without violating the manager’s IC constraint. This leads to greater efficiency during good times. In other words, dispersed debt would allow for stronger (more concentrated) equity without destroying managerial initiative.

Analogous to the discussion on the shape of the return rights, dispersed public debt would then be useful for a firm, if the ex post monetary inefficiency induced by the dispersed debt is not too large relative to the benefit of not having to provide the manager with high rewards following $c_h$. This may be especially beneficial if the firm cannot otherwise set $\alpha_D$ to a low level because of managerial entrenchment (e.g. legal protection during bankruptcy or asymmetric information). The formal mathematical statement of this result is a direct corollary to Proposition 5 and will be omitted.

**Board Representation**

Board representation for large investors can have multiple consequences, many of which are beyond the scope of this paper. However, as a simple illustration of the effects that are developed in this paper, assume that allowing investors to sit on the board leads to the investors being better informed about the firm’s available project choices. This is equivalent to assuming that the investors’ cost of collective action $\alpha$ is lowered (see the model of $\alpha$ in the appendix). The immediate consequence of this assumption is summarized in the following corollary to propositions 1 and 2.

**Corollary 1:**

1. *Board representation for debt holders increases investor returns.*

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36 Again, this interaction effect remains empirically relevant, even if the reason for having debt be dispersed is partially outside the model.
2. **Board representation for equity holders is equivalent to reduced dispersion of equity shares.**

**Proof:** See Appendix

Again, if information gathering is mostly done by concentrated (i.e. bank) lenders, part 1 of the proposition is best interpreted as applying mostly to banks. Evidence along these lines is provided in Kroszner and Strahan (1998), who show that banks are indeed represented on about a third of all boards of large (Fortune 500) US firms. This is in spite of legal restrictions that make it difficult for bankers to sit on boards and in spite of significant potential liabilities arising from the position.

Furthermore, Kroszner and Strahan show that bankers are represented on boards more often in countries where concentrated shareholdings are also more common. This is consistent with the model in this paper, as board representation of debt holders makes debt holders strong while equity concentration makes equity holders strong. As outlined in section 5.3 above, debt and equity powers may be complements rather than substitutes.

### 6. Monetary Incentives and Inside Equity

It is important to understand why more traditional methods of providing incentives fail to provide the first-best outcome. The obvious alternative would be to use monetary incentives (salary and bonus) to provide managerial incentives. It is shown below that extending the manager’s preferences to include utility from monetary payments will **not** make the capital and ownership structures superfluous for incentives. This is true even if monetary payments to the manager are allowed to depend on all contractible variables in the model.

Denote the payments to the manager as $w'(c')$ and $w^2(c', c^2)$. At $t = 0$, investors must solve the following contracting problem:
\[
\max_{(w^I, w^C)} \left\{ p \left( c_h - w^I(c_h) + c^2(\gamma_h) - E \left[ w^2(c_h, \bar{c}^2(\gamma_h, e_h)) \right] \right) \\
+ (1 - p) \left( c_i - w^I(c_i) + c^2(\gamma_i) - E \left[ w^2(c_i, \bar{c}^2(\gamma_i, e_i)) \right] \right) \right\}
\]

\text{s.t.} \quad \left\{ \begin{array}{l}
\left( w^I(c_h) + E \left[ w^2(c_h, \bar{c}^2(\gamma_h, e_h)) \right] + B(\gamma_h) \right) \\
- \left( w^I(c_i) + E \left[ w^2(c_i, \bar{c}^2(\gamma_i, e_i)) \right] + B(\gamma_i) \right) \geq \frac{k}{p}
\end{array} \right. \quad (4)

where \( \gamma_h \) and \( \gamma_i \) are determined endogenously as follows.

Suppose that the capital and ownership structure is not used to provide incentives (i.e. \( \alpha_D = \alpha_E = 0 \) and control rights are allocated to either the outside investor or the manager\(^{37}\)).

**Case IC (investor control):** Suppose that control rights are always associated with the outside investor. Then \( \gamma^{IC}_h \) and \( \gamma^{IC}_i \) are determined by the investor to maximize the payoffs as follows:

\[
\gamma^{IC}_h = \arg \max_{\gamma} \left\{ c_h(\gamma) - E \left[ w^2(c_h, \bar{c}^2(\gamma, e_h)) \right] \right\}
\]

\[
\gamma^{IC}_i = \arg \max_{\gamma} \left\{ c_i(\gamma) - E \left[ w^2(c_i, \bar{c}^2(\gamma, e_i)) \right] \right\}
\] \quad (5)

**Case MC (manager control):** Suppose that control rights are always associated with the manager. Then \( \gamma^{MC}_h \) and \( \gamma^{MC}_i \) are determined by the manager to maximize her private benefits and wages as follows:

\[
\gamma^{MC}_h = \arg \max_{\gamma} \left\{ B(\gamma) + E \left[ w^2(c_h, \bar{c}^2(\gamma, e_h)) \right] \right\}
\]

\[
\gamma^{MC}_i = \arg \max_{\gamma} \left\{ B(\gamma) + E \left[ w^2(c_i, \bar{c}^2(\gamma, e_i)) \right] \right\}
\] \quad (6)

Suppose even that a state-contingent allocation of control rights as in Aghion and Bolton (1992) is allowed, but the ownership structure is still not used (i.e. \( \alpha_D = \alpha_E = 0 \)).

**Case CC (contingent control):** Suppose control rights are allocated to the outside

\(^{37}\) \( \alpha_D = \alpha_E = \text{‘some constant’} \) would lead to similar conclusions.
investor following \( c^l = c_l \) and the manager following \( c^l = c_h \). Then \( \gamma_h^{CC} \) and \( \gamma_i^{CC} \) are determined as follows:

\[
\gamma_h^{CC} = \arg \max_{\gamma} \left\{ B(\gamma) + E\left[ w^2(c_h, \tilde{c}^2(\gamma, e_h)) \right] \right\}
\]

\[
\gamma_i^{CC} = \arg \max_{\gamma} \left\{ c_i(\gamma) - E\left[ w^2(c_i, \tilde{c}^2(\gamma, e_h)) \right] \right\}
\]  

(7)

Suppose now that the capital and ownership structure is utilized as outlined in the previous sections.

Case *: In that case, \( \gamma^*_h \) and \( \gamma^*_i \) are determined as follows:

\[
\gamma^*_h = \arg \max_{\gamma} \left\{ B(\gamma) + E\left[ w^2(c_h, \tilde{c}^2(\gamma, e_h)) \right] \right\}
\]

\[
\text{s.t. } \left[ c^2(\tilde{\gamma}_h) - E\left[ w^2(c_h, \tilde{c}^2(\tilde{\gamma}_h, e_h)) \right] \right] - \left[ c^2(\gamma) - E\left[ w^2(c_h, \tilde{c}^2(\gamma, e_h)) \right] \right] \leq \alpha_E
\]

where \( \tilde{\gamma}_h = \arg \max_{\gamma} \left\{ c^2(\gamma) - E\left[ w^2(c_h, \tilde{c}^2(\gamma, e_h)) \right] \right\} \)

(8)

and

\[
\gamma^*_i = \arg \max_{\gamma} \left\{ B(\gamma) + E\left[ w^2(c_i, \tilde{c}^2(\gamma, e_h)) \right] \right\}
\]

\[
\text{s.t. } \left[ c^2(\tilde{\gamma}_i) - E\left[ w^2(c_i, \tilde{c}^2(\tilde{\gamma}_i, e_h)) \right] \right] - \left[ c^2(\gamma) - E\left[ w^2(c_i, \tilde{c}^2(\gamma, e_h)) \right] \right] \leq \alpha_D
\]

where \( \tilde{\gamma}_i = \arg \max_{\gamma} \left\{ c^2(\gamma) - E\left[ w^2(c_i, \tilde{c}^2(\gamma, e_h)) \right] \right\} \)

(9)

The following proposition shows that the capital and ownership structure is important for the provision of incentives even in the presence of monetary incentives.

**Proposition 6:** Providing incentives via the capital and ownership structure (case *)
can achieve all outcomes that can be reached in cases IC, MC, and CC. Furthermore, there are some outcomes which are optimal and that can only be reached by providing incentives through the capital and ownership structure.

**Proof:** See Appendix.

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38 It is trivial to show that the opposite allocation is not optimal. In that case, the manager would be given control (which she values because of her private benefits) following bad performance and no control following good performance. This has no ex post benefits relative to pure investor control and makes it harder to provide ex ante incentives.
This result is driven by the fact that the private benefits of the manager cannot be transferred to the investors (at least not dollar for dollar). In other words, as the manager is paid a salary, the cost of the salary is not offset one-for-one in improved performance as long as the private benefits of the manager increase/decrease at a different rate than firm cashflows. A manager’s salary is an expensive (and imperfect) incentive mechanism as long as the private benefits that she derives from control are large when compared to managerial wealth but small when compared to the effect the managerial discretion has on overall firm performance. Since management will 'consume' the private benefits in any case (they cannot be converted to cash and traded off against cashflow effects), the firm might as well 'utilize' the effects of the private benefits by giving management some control as a reward, rather than 'fighting' the effects of private benefits by promising high salaries at $t = 0$ and then insisting on slightly more cashflow efficient projects at $t = 1$ even though they are highly undesirable to management.

On a technical note, one can view the allocation of effective control (or power) as an additional instrument (one which cannot be simulated by cash payments, because $\gamma$ is not contractible) that can be used to provide managerial incentives. In particular, it is an instrument which comes partially for free, as the state-contingent allocation of private benefits might have large incentive effects without having a large direct cost in terms of foregone cashflows.

7. Conclusion

This paper demonstrates several effects of the interaction of the capital structure and ownership dispersion in manager-run corporations. These effects are expressed as empirical predictions which include the following: (i) strong, concentrated equity ownership is associated with strong, concentrated debt holdings; (ii) if long term firm specific investment are important, then the equity should be more dispersed (for a given
(iii) board representation by banks is desirable, especially if equity ownership is concentrated; (iv) Environments with weak (tough) bankruptcy procedures may be associated with relatively dispersed (concentrated) equity ownership patterns. (v) tough debt covenants may be more prevalent in environments that also favor large equity holders.

As a negative result, the model predicts that observing concentrated or dispersed equity ownership should not (necessarily) lead to observing differences in firm performance, unless one controls for the firm’s capital structure. This finding is consistent with the wide variation of equity ownership structures observed both across countries and within countries. Simply put, unless all mechanisms that affect the allocation of effective control (equity dispersion, capital structure, board representation, legal system, debt concentration, etc.) are taken into account, tests for an equity concentration – firm performance relationship can (at best) be consistent, but will not be very powerful.

Finally, the optimal incentives provided by the capital and ownership structure cannot be simulated by a carefully designed monetary incentive scheme.
Appendix

The Cost of Collective action - $\alpha$

To illustrate the connection between shareholder dispersion and the cost of collective action ($\alpha$), consider the following illustrative extension of the basic model:

Let the control rights over selecting a project $\gamma$ from the set $\Gamma$ lie with a subset $I$ of the investors. Assume that $I$ consists of one large investor, who owns a fraction $\delta$ of the shares, and a fringe of atomistic shareholders who own the rest.\(^{39}\) As in Burkart, et al. (1997), this variable $\delta$ can be thought of as a measure of how dispersed the shares of the firm are among the investors (or how dispersed the debt is).

At $t = 0$, investors can choose to monitor the firm with intensity $m$. The cost of monitoring is given by $\frac{1}{2} \rho m^2 + \varepsilon$, where $\varepsilon$ is a small fixed cost. At $t = 1$, if the manager proposes a project $\gamma$, then the resulting cashflows (at $t = 2$) will again be $c^2(\gamma, e)$. However, if the investors insist on some other project $\gamma'$, then this results in $c^2(\gamma', e) - \tilde{q}$, where $\tilde{q} = 0$ with probability $m$ and $\tilde{q} = Q > 0$ with probability $(1 - m)$. This formalizes the notion that investors can 'make mistakes' when they choose to overrule the manager's proposed course of action, but the probability of making mistakes is reduced by monitoring.

The fact that the investors are less able to make decisions and the fact that no one owns 100% of the firm's cashflow rights act as a cost when it comes to overruling the manager. This is because the largest investor, even though she will monitor, will only monitor to the extent that her own share of firm profits (and not total firm profits) are affected. Hence, she will (rationally) remain partially ignorant about firm prospects and investors face an (expected) cost of overruling the manager in terms of a positive probability of choosing the 'wrong' project. This expected cost is given by $(1 - m)Q$, which is equivalent to the $\alpha$ in the model of the paper. This intuition is formally shown as follows:

Clearly, the small fixed cost of monitoring would cause the atomistic shareholders to free ride on the efforts of the large investor. The large investor would choose a monitoring intensity $m^*$ such that her security benefits are maximized:

\(^{39}\) This specification allows me to abstract from the potential strategic interactions between multiple large investors, a topic somewhat tangential to the current inquiry.
\[ m^* = \arg \max_m \left\{ \delta c^2(\gamma_m) - \left( \frac{1}{2} \rho m^2 + \varepsilon \right) \right\} \]  

(A1)

where \( \gamma_m \) is the choice of project that the manager is expected to propose at \( t = 1 \). This choice \( \gamma_m \), in turn, is determined by the manager in reaction to how much monitoring the investor is expected to do. Thus, the manager solves her maximization problem subject to the constraint that the investor, given the choice of \( m \), should not want to overrule her. This maximization is given by:

\[ \gamma_m = \arg \max_{\gamma} \left\{ B(\gamma) \right\} \quad \text{s.t.} \quad \left[ c^2(\gamma^*) - c^2(\gamma) \right] \leq (1 - m^*)Q. \]  

(A2)

The following parameter restrictions guarantee an interior solution:

**Assumption A1:**

(i) \( Q < c^2(\gamma^*) - c^2(\gamma_m^*) \), where \( \gamma^* \) maximizes \( c^2(\cdot) \) and \( \gamma_m^* \) maximizes \( B(\cdot) \).

(ii) \( \delta Q < \rho \).

The solution to the program is described in the following proposition:

**Proposition A1:**

(i) The optimal level of monitoring is \( m^* = \frac{\delta Q}{\rho} \)

\[ a) \frac{d}{d\delta} (1 - m^*)Q < 0 \]

(ii) Comparative Statics:

\[ b) \frac{d}{d\rho} (1 - m^*)Q > 0 \]

\[ c) \frac{d}{dQ} (1 - m^*)Q > 0 \]

**Proof:** Part (i) - from assumption A1(i), we see that the constraint in equation A2 is binding at any level of \( m \) between 0 and 1. Thus, we can use the constraint to compute the total derivative of \( c^2(\gamma_m) \) with respect to \( m \) as \( \frac{dc^2(\gamma_m)}{dm} = Q \). This can be used to solve the maximization in equation A1. The F.O.C. is then given by \( \delta Q - \rho m = 0 \), which leads to the \( m^* \) of the proposition. Assumption A1(ii) ensures that \( m \) is strictly between 0 and 1. Part (ii) follows by inspection. QED

The quantity \( (1 - m^*)Q \) is exactly the \( \alpha \) of the model in the main part of the paper. The comparative statics are as expected: \( \alpha \) decreases with the level of ownership concentration (\( \delta \)), it increases with the cost of monitoring (\( \rho \)) and it increases with the informational disadvantage of the investors vis-à-vis the manager (\( Q \)).
Proof of Proposition 1:

Part I:
The optimal contract must maximize expected cashflows subject to the manager’s incentive compatibility constraint (IC). Hence, the optimal contract must lead to project choices \( \gamma_h \) and \( \gamma_l \) such that:

\[
(\gamma_h, \gamma_l) = \arg \max_{(\gamma_h, \gamma_l)} \left\{ p\left[c_h + c^2(\gamma_h)\right] + (1-p)\left[c_i + c^2(\gamma_l)\right] \right\}
\]

s.t. \( B(\gamma_h) - B(\gamma_l) > \frac{k}{p} \)  \hspace{1cm} (A3)

This program is identical to the one in the proposition, except that in the proposition the \( \gamma \)’s are written as functions of \( \alpha_D \) and \( \alpha_E \). This functional dependence is a direct result of the managerial optimization problem. For any level of \( \alpha \), the manager will choose a project \( \gamma_\alpha \) which solves the following program:

\[
\gamma_\alpha = \arg \max_{\gamma} \{ B(\gamma) \} \quad \text{s.t.} \quad c(\gamma^*) - c(\gamma) \leq \alpha \]  \hspace{1cm} (A4)

Any other choice of \( \gamma \) would be either (i) suboptimal for the manager (if the constraint is slack) or (ii) overruled by the investors (if the constraint is violated). If it were overruled, the investors would implement \( \gamma^* \), which leads to lower private benefits to the manager - hence the manager will choose \( \gamma_\alpha \) instead. Thus, \( \gamma \) is a function of \( \alpha \) and the program in the proposition corresponds to the program in equation A3, which is the program which leads to the optimal contract. Assumption 2 ensures that a solution exists.

Part II:

1. \( \alpha^*_h \geq \alpha^*_i \): suppose not. Then, because \( B(\gamma_\alpha) \) is increasing in \( \alpha \), we know that \( B(\gamma_\alpha_i) \leq B(\gamma_\alpha_h) \) and the manager’s IC must fail. From Assumption 2 this cannot be optimal.

2. \( \alpha^*_i = 0 \) is optimal: suppose not. Then for a given \( \alpha_h \) the expected cashflows to the investors would (weakly) increase by setting \( \alpha_i = 0 \) as a more efficient \( \gamma \)
would be chosen. Furthermore, the manager’s IC can most easily be met at $\alpha_l = 0$, because $\forall \alpha > 0, B(\gamma_{\alpha}) \geq B(\gamma_0)$.

Finally, all cashflows accrue to the investors, because the manager does not respond to monetary incentives.

QED

**Proof of Proposition 2:** Given the results of proposition 1, two things must be shown:

1) $\gamma_{a_{E}}$ is selected following $c^l = c_h$, and

2) $\gamma^*$ is selected following $c^l = c_l$.

Part 1): When $c^l = c_h$, there is enough cash in the firm for the manager to pay the coupon payment and have control rights remain with equity. Since the manager is better off under equity control (which is subject to a cost of collective action), she would always pay the coupon if she can. The debt holders have no ability to interfere as they have no control rights. Equity holders will acquiesce to the manager’s favorite choice of project as long as it is not worse (in cashflow terms) than $\gamma^*$ by more than $\alpha_{E^*}$. This is, by definition, $\gamma_{a_{E^*}}$.

Part 2) When $c^l = c_l$, there is not enough cash in the firm to pay the coupon payment. If the manager cannot raise new money, debt receives control rights. Debt holders utilize the control rights to maximize their return by choosing $\gamma^*$. The manager cannot raise new funds to avoid debt control, as all cashflows that can possibly be generated are already promised to debt holders (who have been given seniority over new securities). Since the manager’s private benefits are non-transferable, there is nothing she can do. Similarly, equity holders cannot do anything as they have nothing to offer to debt holders. Finally, because $\gamma^*$ is ex post efficient, there is no reason for renegotiation.

QED
Proof of Proposition 3: From proposition 1, we know that $\alpha \leq \alpha_0$. Hence, the expected cashflows to the firm are
\[c_l + c^2(\gamma),\] (A5)
if $\alpha_0 = 0$ and the manager’s IC is not met. Similarly, they are
\[p\left[c_h + c^2(\gamma_{\alpha_h}^*)\right] + (1 - p)\left[c_l + c^2(\gamma^*)\right] + \kappa,\] (A6)
if $\alpha_h = \alpha_h^*$ (where $\alpha_h^*$ is defined as in proposition 1). Since $\gamma_{\alpha_h}$ and $\gamma^*$ in equations A5 and A6 do not depend on $\kappa$, it is clear that A6 is more likely to be larger than A5 (and hence $\alpha_h = \alpha_h^* > 0$ is optimal) if $\kappa$ is large.

QED

Proof of Proposition 4: Investor profits following high effort,
\[p\left[c_h + c^2(\gamma_{\alpha_E}^*)\right] + (1 - p)\left[c_l + c^2(\gamma_{\alpha_D}^*)\right]\] (A7)
are weakly decreasing in $\alpha_E^*$. Thus, the only reason for a positive $\alpha_E$ is to meet the manager’s IC constraint,
\[B(\gamma_{\alpha_E}) - B(\gamma_{\alpha_D}) \geq \frac{k}{p}\] (A8)
where $\alpha_D$ has been set to its optimal (lowest) level - $\alpha_0$. Hence, the comparative statics derive entirely from the constraint. Lowering $\alpha_D$ allows the IC constraint to be met with a (weakly) lower $\alpha_E$ - in other words, $\alpha_E^*$ decreases. Increasing $\alpha_D$ requires a (weakly) higher $\alpha_E$ to meet the IC constraint - in other words, $\alpha_E^*$ increases.

QED

Proof of Proposition 5: Part 1: Since making the return rights of the security with control rights after $c^I = c_l$ concave leads to some ex-post inefficiency ($\gamma_D \neq \gamma^*$) in the
low state, it is only useful if it allows for more efficiency in the high state. In other words, it requires that the manager’s IC can be met with a more efficient choice of $\gamma$ following $c^l = c_h$. From the form of the manager's IC constraint,

$$B(\gamma|c^l = c_h) - B(\gamma|c^l = c_i) \geq \frac{k}{p}$$

(A9)

it is obvious that this can only be true if $B(\gamma) < B(\gamma^*)$.

Part 2): It needs to be shown that expected cashflows are higher under the concavity of debt returns. Using the definitions from the proposition, the expected cashflows with concavity are given by

$$p(c_h + c^2(\gamma_{a_e})) + (1-p)(c_i + c^2(\gamma_D))$$

(A10)

The expected cashflows without concavity are given by

$$p(c_h + c^2(\gamma_{a_e})) + (1-p)(c_i + c^2(\gamma^*))$$

(A11)

Thus, concavity is better if (A10) is larger than (A11), which reduces to the statement in the proposition.

QED

Proof of Corollary 1:

Part 1: Since, for lower $\alpha_D$, both (i) the manager's incentive compatibility constraint is easier to meet and (ii) ex post efficiency is increased, the result follows.

Part 2: Follows directly from the discussion about $\alpha$ at the beginning of the appendix.

QED
proof of proposition 6: the first part follows by inspection: using $\alpha_h = 0$ and $\alpha_l = 0$ leads to case IC, $\alpha_h = \infty$ and $\alpha_l = 0$ leads to case MC, $\alpha_h = \infty$ and $\alpha_l = 0$ leads to case CC.

the second part is an existence statement and can - in the interest of brevity - most easily be shown by example. it is easy to verify in figure 2 below that, for the following specification, the capital and ownership structure as an incentive mechanism (using $\alpha_h = 0.6$ and $\alpha_l = 0$) dominates cases IC, MC, and CC: $I = \{ \gamma_1, \gamma_2, \gamma_3 \}$, $c_l = 0$, $c_h = 4$, $B(\gamma_1) = 0$, $B(\gamma_2) = 2$, $B(\gamma_3) = 3$, $c^2(\gamma_1) = 5$, $c^2(\gamma_2) = \tilde{x}$, $c^2(\gamma_3) = 0$, where $\tilde{x}$ is either 5 or 4 with equal probability; also $p = 0.6$, $k = 1$, $\kappa = 1$. (Intuition: using $\alpha_h = 0.6$ and $\alpha_l = 0$ we can implement $\gamma_h = \gamma_2$ and $\gamma_l = \gamma_1$ without paying any explicit wage. Under IC, MC, and CC this can not be done. Furthermore, using monetary wages and not freedom to choose projects to induce the manager to exert effort would cost more in terms of explicit salary than it costs to allow the manager some limited freedom in project choice.)

figure 2

```
<table>
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<th>t = 0</th>
<th>t = 1</th>
<th>t = 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>c^1 = 4</td>
<td>\gamma_1</td>
<td>c^1 = 0</td>
</tr>
<tr>
<td>0.6</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>B = 0, c^2 = 6</td>
<td>B = 0, c^2 = 6</td>
<td></td>
</tr>
<tr>
<td>B = 2, c^2 = 6</td>
<td>B = 2, c^2 = 5</td>
<td></td>
</tr>
<tr>
<td>B = 3, c^2 = 1</td>
<td>B = 3, c^2 = 1</td>
<td></td>
</tr>
</tbody>
</table>

| c^1 = 0 | \gamma_2 | c^1 = 0 |
| 0.4 | 0.5 | 0.5 |
| B = 0, c^2 = 6 | B = 0, c^2 = 5 |
| B = 2, c^2 = 6 | B = 2, c^2 = 5 |
| B = 3, c^2 = 1 | B = 3, c^2 = 1 |

| c^1 = 0 | \gamma_3 | c^1 = 0 |
| 0.5 | 0.5 | 0.5 |
| B = 0, c^2 = 5 | B = 0, c^2 = 5 |
| B = 2, c^2 = 5 | B = 2, c^2 = 4 |
| B = 3, c^2 = 0 | B = 3, c^2 = 0 |
```

40 The fully worked-out optimal wages can be obtained from the author or the author’s web-page.
References


