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Sharing of Control as a Corporate Governance Mechanism

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09-01

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Sharing of Control as a Corporate Governance Mechanism

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December 7, 2000

Abstract

This paper identifies a new corporate governance mechanism: sharing control. We show that bargaining problems among multiple controlling shareholders may prevent inefficient investment decisions that harm minority shareholders. The same bargaining problems may block efficient investment decisions, though. By solving this trade-off, we show that the likelihood that shared control is efficient increases with three firm characteristics: over-investment problems, the cost of verifying cash flows, and financing requirements. The model provides testable implications for the role that large shareholders play in corporate governance, contrasting shared control and monitoring as alternative governance mechanisms.

JEL: G30, G34, G32. KEYWORDS: Sharing of control, corporate governance, monitoring, investment decisions.

*We would like to thank Yakov Amihud, Chris Geczy, Gary Gorton, Dennis Gromb, Matthias Kahl, Oded Sarig, and seminar participants at University of Chicago and the 1999 AFE meeting in New York for valuable comments. Gomes also thanks the support of the Rodney L. White Center for Financial Research.

This paper identifies a new corporate governance mechanism, namely, sharing control. Sharing control occurs when a single shareholder cannot make unilateral decisions in the firm. In this setting, multiple controlling shareholders can veto major corporate decisions, leaving scope for disagreements. As it turns out, these bargaining problems may prevent business decisions that harm minority shareholders. The same bargaining problems may block efficient decisions, though. By solving this trade-off, we show that the likelihood that sharing control is efficient increases with three firm characteristics: overinvestment problems, the cost of verifying cash flows, and financing requirements. The model provides testable implications for the role that large shareholders play in corporate governance, contrasting shared control and monitoring as alternative governance mechanisms.

As Grossman and Hart (1986) argue, part of a firm's value consists of benefits of control that are not enjoyed by outside investors; a controlling group's ability to appropriate corporate assets for personal use, empire building motives in the selection of projects, etc. Private benefits of control create conflicts of interest between the controlling and the minority shareholders. For instance, a controlling shareholder may be tempted to forego a profitable project (e.g., down sizing) if it destroys private benefits of control. Thus, inefficient decisions that are against the interests of minority shareholders may happen if the controlling group is left unchecked.

Accordingly, a large literature in corporate control has explored ways to protect minority shareholders. In particular, the monitoring of investment decisions by large shareholders has been singled out as an important mechanism to protect the value of minority shares. As Pagano and Roell (1998), Bolton and Von Thadden (1998), and Burkart, Gromb, and Panunzi (1997) have recently suggested, however, monitoring by outside investors also entails costs. Because outside investors do not internalize the private benefits of control, excessive monitoring may result.

In this paper, we argue that sharing control protects minority shareholders while preserving valuable private benefits of control. The governance role of shared control stems from two sources. First, sharing control implies that fewer minority shares have to be sold to satisfy financing needs. Thus, controlling groups internalize firm value to a greater extent, reducing their incentives to implement business decisions that increase private benefits at a high efficiency cost. Note, however, that, despite the increased equity stake, the control group still internalizes the private benefits of control. Hence, contrary to outside monitoring, shared control is unlikely to sacrifice valuable private benefits of control to protect minority shareholders.

A second source of increased value from shared control arises from ex-post bargaining problems among controlling shareholders. These bargaining problems may prevent business decisions that are in the collective interest of a controlling group, but harm minority shareholders. Controlling shareholders have strong incentives to avoid costly disagreements, though. Sharing control, therefore, provides a compromise between the excessive monitoring of an outside investor who does not internalize the private benefits, and the excessive discretion of an unchecked controlling shareholder.

Like most compromises, sharing control will not always be efficient. Ex-post bargaining problems among controlling shareholders may lead to underinvestment problems, reducing the firm's overall efficiency and possibly hurting the minority shareholders as well. Still, we shall show that sharing control is an efficient corporate governance mechanism in firms with significant overinvestment problems and large financing requirements.

Perhaps more interestingly, sharing control protects minority shareholders regardless of a court's ability to detect conflicts of interest in business decisions. In contrast, the threat of litigation should be crucial for the effectiveness of an outside monitor. Hence, the model predicts that, from an efficiency perspective, sharing control is likely to dominate monitoring as a governance mechanism in firms with overinvestment problems, large financing requirements, and high costs of verifying cash flows. In these firms, large shareholders should have a direct participation in the management; fighting to advance their own corporate agenda and yet protecting the cash-flow rights of the minority shareholders.

The model's implications for the role that large shareholders play in corporate governance can be tested. For example, the innovative nature of and R&D project makes it harder to verify its expected return. As such, firms with large R&D investments are good candidates for sharing control to be efficient. In these firms, overinvestment problems and financing requirements are likely to be large, and the difficulty of assessing the returns of R&D investments reduces a monitor's ability to convince a court to overturn the management's decision. The model thus predicts that shared control should be more pervasive in firms with large R&D investments.

Of course, testing this prediction requires a proxy for the presence of multiple controlling shareholders. As it turns out, contractual arrangements among controlling shareholders – the shareholders' agreements – provide us a proxy for shared control. Ex post, controlling shareholders have incentives to trade away the same conflicts that protect the minority shareholders. For instance, seeking to advance their own corporate agenda, a coalition of controlling shareholders could try to exclude one or more members of the controlling group from the firm's decisions. Shareholders' agreements can avoid these ex-post incentives by imposing restrictions on the sale of control shares. These restrictions limit the controlling shareholders' ability to form new coalitions. Also, voting agreements can give veto power on major business decisions to each member of the control group, effectively preventing exclusions from the controlling group.

Although we are not aware of any empirical study of the use of shareholders' agreements in the U.S., the Securities and Exchange Commission (SEC) requires that firms with publicly traded securities disclose the presence of any shareholders' agreement, making them available in their EDGAR database. The existence of shareholders' agreements in a firm, therefore, can be used as a proxy of shared control.[1] Thus, the model predicts that shareholders' agreements should be more pervasive in firms with large R&D investments.

The paper closest to ours is Bennedsen and Wolfenzon (2000), who show that the presence of large shareholders outside the control group increase firm value. In their paper, a large outside shareholder forces the controlling group to amass a greater equity stake or else control may be lost. The larger equity stake increases efficiency because it makes the controlling group internalize more of the firm's value.[2] In contrast, we focus on the bargaining problems among controlling shareholders and ignore the coalition games that lead to the establishment of a controlling group.

The remainder of the paper is organized as follows. Section I describes the model. Section II proves that sharing control is an efficient governance mechanism in firms with overinvestment problems and large financing requirements. Section III shows that a high cost of verifying

[1]Black and Gilson (1997) report that shareholders' agreements are often present in the venture capital industry.

[2]Harris and Raviv (1988) and Stulz (1988) also focus on the equity stake of a controlling group. In these papers, however, the goal is to investigate the capital-structure implications of a controlling group's attempt to defeat a control contest.

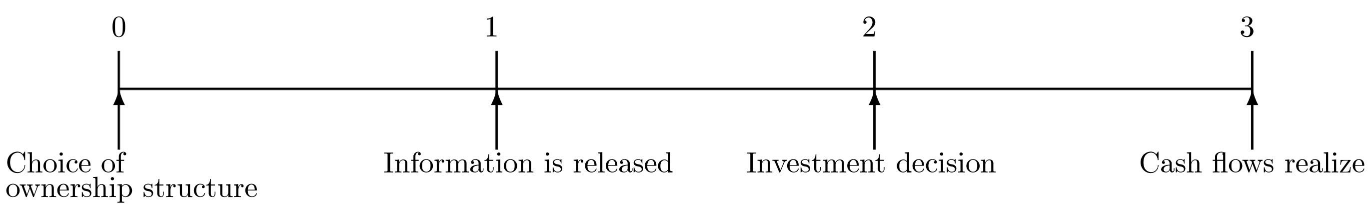
cash flows increases the chances that sharing control dominates monitoring as a governance mechanism. Section IV discusses the role of shareholders' agreements in implementing an optimal ownership structure. Section V discusses some empirical implications and a conclusion follows. Proofs of the propositions that are not present in the text can be found in the appendix.

I Framework

Our starting point is a firm whose single shareholder seeks outside investors to finance new projects. For simplicity, all agents are risk-neutral and the risk-free interest rate is zero.

A Timing

Figure 1: Timing of events



The model has one production period and four dates. At time $t = 0$, an investment opportunity becomes available and the initial shareholder looks for outside investors to finance the cost I of the project. Since the main focus of this paper is on the interaction between a firm's ownership structure and the protection of minority shareholders, we assume that the financing of the project requires attracting new shareholders. Debt financing is thus ruled out. (One interpretation of this assumption is that the firm has exhausted its debt capacity and the initial shareholder is credit constrained.) As such, the financing of the project creates a link between firm value and ownership structure.

Additional information about the project's payoff is released at time $t = 1$, and the final decision on the investment is made at time $t = 2$. Cash flows realize at $t = 3$, when the firm is liquidated. Figure 1 summarizes the timing and the main events of the model.

B Ownership structure

We describe the firm's ownership structure after the project financing by a vector $(\alpha_1, \alpha_2, \gamma)$, where $\alpha_1 \in (0,1)$ is the fraction of shares held by the initial shareholder; $\alpha_2 \in [0,1)$ is the fraction of shares of the second controlling shareholder (if any); and $\gamma = 1-\alpha_1-\alpha_2$ is the total fraction of shares of dispersed shareholders who will have no say on the investment decision.[3] If the initial shareholder decides to share control, i.e., $\alpha_2 > 0$, both controlling shareholders have veto power over the investment decision. Hence, if they disagree on whether to undertake the project, we assume that the status quo prevails. In other words, the investment happens only if there exists unanimity. (Section IV discusses mechanisms that give veto power to the controlling shareholders.)

The initial shareholder's problem is to choose the ownership structure that maximizes the firm's value conditioned on raising the investment requirement I.

C Cash flows

The ownership structure choice is relevant to the firm's value only if shareholders may have different incentives to undertake the project. As in the modern literature on the theory of firm (e.g., Grossman and Hart (1986) and Hart and Moore (1990)), we obtain conflicting incentives on the investment decision by introducing nonverifiable cash flows – the private benefits of control –, which are fully captured by the shareholders who run the firm, that is, the controlling shareholders.

Accordingly, we decompose the project's cash flows in two parts: the verifiable cash flow, $I + y$, which is the sum of the investment requirement I and its return y, and the private benefit component, b. In this setting, $b < 0$ if the project reduces the private benefits vis-à-vis the status quo. For instance, down sizing the firm may increase profits and yet reduce the utility of a controlling shareholder who is an empire builder.

[3] Although all the arguments of this paper apply to ownership structures with more than two controlling shareholders, the analysis is simpler if we restrict attention to two controlling shareholders. Note also that ownership structures with more than two controlling shareholders do not seem to be empirically relevant. Zwiebel (1995), for instance, reports that the Fortune 500 firms of 1981 had an average of 1.4 shareholders with blocks greater than 5% of the total capital.

Although there are reasons to believe that the number of controlling shareholders may have an impact on the distribution of the project's payoffs, the direction of this effect is uncertain.[4] As such, we assume that the distributions of b and y do not depend on the number of controlling shareholders. This assumption implies that $\sum_{i=1}^{2} b_i = b$, where b is the private benefit of the project in an ownership structure with a single controlling shareholder, and b_i is the private benefit of controlling shareholder $i \in \{1, 2\}$ under shared control.

D Information structure

When the initial shareholder chooses the ownership structure (time $t = 0$), information is symmetric: the payoffs of the project, b and y, are random variables with a joint probability that is publicly known. Before making the investment decision (time $t = 1$), the controlling shareholders learn the verifiable return, y, and their own private benefits from the project, b_i (possibly negative).[5] By their very nature, however, the benefits of control of each controlling shareholder are likely to be privately known. Therefore, we assume that controlling shareholder $i \in \{1, 2\}$ observes only a noisy signal s_j of the private benefit of the controlling shareholder $j \neq i$. This noisy signal satisfies $b_j = s_j + \epsilon_j$ with $\epsilon_j \in [-\frac{\epsilon}{2}, \frac{\epsilon}{2}]$ and $\epsilon > 0$.

Conditioned on s_j, the true private benefit b_j is uniformly distributed in the interval $[s_j - \frac{\epsilon}{2}, s_j + \frac{\epsilon}{2}]$. Hence, the realization of s_j implies that controlling shareholder i's posterior on b_j is independent of b_i. Note also that we do not impose restrictions on the distribution of the signals (s_1, s_2). As such, our results do not rely on how the private benefits of control are shared. Thus, the model is consistent with a sharing rule that gives the smallest fraction of the total private benefits (possibly zero) to the the controlling shareholder with the lowest equity stake. Finally, we assume that the signals s_1 and s_2 are observed by both controlling shareholders. (But not by the outside investors.)

[4] For instance, a large number of controlling shareholders may increase the efforts of unlocking private benefits. If so, the private benefits should stochastically increase with the number of controlling shareholders. There are also incentives in the opposite direction, however. A large number of controlling shareholders might lead to a destructive fight for private benefits.

[5] If there is only one controlling shareholder, $b_1 = b$, implying that the shareholder in control learns the total private benefits of the project.

II The Efficiency of Sharing Control

This section demonstrates that bargaining problems among multiple controlling shareholders may increase firm value. We characterize the costs and benefits of sharing control, obtaining a sufficient condition for its efficiency.

A Investment under the initial shareholder's control

To characterize the costs and benefits of sharing control, we first derive the firm's value under a single controlling shareholder. As such, assume that the initial shareholder raises the investment requirement I by selling a fraction $1-\alpha_1$ of the firm's equity to dispersed shareholders, who have neither the power nor the incentives to interfere in the business decisions. In this case, an inefficient project, $y+b<0$, will be profitable for the initial shareholder if the private benefits are high enough to offset her share of the negative verifiable return, that is, $b>-\alpha_1 y$.[6] Likewise, an efficient project will be foregone, $y+b>0$, if it implies a reduction in the private benefits of control, $b<0$, that offsets the controlling shareholder's share of the verifiable return y. Both underinvestment and overinvestment may then result, implying the following set of states where a single controlling shareholder distorts the investment decision:

$$\mathcal{D}^1(\alpha_1)=\{(y,b): y+b<0 \text{ and } \alpha_1 y+b\geq 0, \text{ or } y+b>0 \text{ and } \alpha_1 y+b\leq 0\}, \quad (1)$$

where the superscript in $\mathcal{D}^1$ denotes an ownership structure with a single controlling shareholder, and α_1 is the equity stake of the controlling shareholder.

To quantify the efficiency cost of an ownership structure with a single controlling shareholder, let $\mathcal{X}_{\mathcal{D}^1(\alpha_1)}$ be an indicator variable that takes value 1 if $(y,b)\in\mathcal{D}^1(\alpha_1)$ and zero otherwise. Thus, $|y+b|\mathcal{X}_{\mathcal{D}^1(\alpha_1)}$ is either the absolute value of the negative payoff of an inefficient project, or the positive payoff of an efficient project that is foregone. The expected cost of an ownership structure with a single controlling shareholder is then

$$D^1(\alpha_1)=E[|y+b|\mathcal{X}_{\mathcal{D}^1(\alpha_1)}], \quad (2)$$

[6] Bebchuk and Zingales (1998) use a similar conflict between minority and controlling shareholders to explain why a firm's decision to go public may not be socially optimal.

where the expectation uses the joint distribution of y and b.

It can be easily shown that the incentives to distort the investment decision decrease with the controlling stake α_1 (a larger stake makes the controlling shareholder internalize the firm's value to a greater extent). As a result, it is in the initial shareholder's interest to sell as few minority shares as possible. The optimal ownership structure with a single controlling shareholder is then $(\alpha_1 = \alpha_1^\star, \alpha_2 = 0, \gamma = 1 - \alpha_1^\star)$, where $1 - \alpha_1^\star$ is the minimum minority stake that raises the financing requirement I, that is,

$$(1 - \alpha_1^\star)\{V_0 + I + E[y|b + \alpha_1^\star y > 0]\} = I, \tag{3}$$

where the conditional expectation of the verifiable return $(E[y|b+\alpha_1^\star y > 0])$ takes into account that the project will be undertaken if and only if it is profitable for the controlling shareholder, and V_0 is the value of the assets in place prior to the equity issue.

B Investment with shared control

Private benefits of control create conflicts of interest within a controlling group. For instance, the Wall Street Journal of May 13, 1998 (page B10) reports that Ted Turner, Vice Chairman and the largest individual shareholder (11%) of Time Warner, had for a second time vetoed the sale of the group's legal channel, Court TV, to Discovery Communications Inc. Allegedly, Ted Turner was concerned with a new owner transforming the legal channel into a competitor to CNN, the flagship of Turner Broadcasting's own cable channel and also a member of the Time-Warner group. According to the Wall Street Journal, Mr. Turner prevailed over Gerald Levin, Time Warner's Chairman, who did not internalize the consequences to CNN of the sale of Court TV to Discovery as much as Mr. Turner.

In the context of our paper, conflicts of interest between the controlling shareholders arise if $b_i + \alpha_i y > 0$ and $b_j + \alpha_j y < 0$ for $i \neq j$, where $b_i + \alpha_i y$ is controlling shareholder i's valuation for the project. In this case, controlling shareholder i has incentives to offer controlling shareholder j a side payment to assure the undertaking of the project. Since the benefits of control of each controlling shareholder are privately known, the investment decision amounts to a bargaining game under imperfect information.

To solve this bargaining problem, we use a mechanism studied by Chatterjee and Samuelson (1983), which is a natural generalization of the Nash bargaining solution to a setting with imperfect information. In this mechanism, the controlling shareholders simultaneously announce their valuations of the project – call them V_i for $i \in \{1, 2\}$. The project is undertaken if and only if $V_1 + V_2 \geq 0$, in which case the two controlling shareholders split their announced benefits. The split of the announced benefits is implemented by a transfer, t, from the first controlling shareholder (the initial one) to the second one. If the project is not undertaken, no side payment is required. The transfer thus solves $V_1 - t = V_2 + t$ or $t = \frac{V_1 - V_2}{2}$.[7]

The transfer payment implies that, conditioned on the investment being made, the two controlling shareholders gain by shading their valuations of the project. Of course, reducing the announced valuation will also increase the chances that the project will not be undertaken (remember that the investment happens if and only if $V_1 + V_2 \geq 0$). When shading their valuations, each controlling shareholder will thus weigh a higher gain in the event that the project is undertaken against a higher probability that a valuable project is foregone.

To solve this trade-off, we look for a Bayesian equilibrium in which the announcements of the controlling shareholders depend on their own valuations for the project, $b_i + \alpha_i y$, and their guesses of the announcement of the other controlling shareholder. The Bayesian equilibrium is described by a pair of functions, $(V_1(b_1 + \alpha_1 y, s_1, s_2), V_2(b_2 + \alpha_2 y, s_1, s_2))$, where the announcement of the first controlling shareholder, $V_1(b_1 + \alpha_1 y, s_1, s_2)$, solves

$$\max_{V_1} \int_{V_2^{-1}(-V_1, s_1, s_2) - \alpha_2 y}^{s_2 + \frac{\epsilon}{2}} (b_1 + \alpha_1 y - \frac{V_1 - V_2(b_2 + \alpha_2 y, s_1, s_2)}{2}) f_2(b_2 | s_2) db_2. \tag{4}$$

The objective function in program (4) is the expected payoff of the initial shareholder given her announcement of V_1; her true valuation of the project, $b_1 + \alpha_1 y$; and the signals s_1 and s_2. This payoff is uncertain, for two reasons. First, the transfer payment $t = \frac{V_1 - V_2}{2}$ depends on the second controlling shareholder's announcement, V_2, which is a function of her unknown valuation for the project. Second, announcing V_1 will block the project if $V_1 + V_2 < 0$, or equivalently, $V_2 < -V_1$. Hence, the lower the announced V_1, the higher the chances that the project will not be undertaken. In fact, given V_1, the lowest V_2 that leads to the acceptance of

[7] Proposition 4 implies that the initial shareholder can sell control shares in excess to the financing requirement without reducing firm value. As a result, the initial shareholder can sell enough control shares to afford transfer payments in the bargaining game.

the project solves $V_1 + V_2(b_2 + \alpha_2 y, s_1, s_2) = 0$, which implies that $V_1 + V_2(b_2 + \alpha_2 y, s_1, s_2) > 0$ if and only if $b_2 + \alpha_2 y > V_2^{-1}(-V_1, s_1, s_2)$, where $V_2^{-1}(.)$ is the inverse function of $V_2(b_2 + \alpha_2 y, .)$.[8] Therefore, the expectation of the initial shareholder's payoff is taken with respect to b_2 (using the density that the signal s_2 induces, $f_2(b_2|s_2)$) for values higher than the cut-off $V_2^{-1}(-V_1, s_1, s_2) - \alpha_2 y$.

Analogous to program 4, the optimal announcement of the second controlling shareholder solves

$$\max_{V_2} \int_{V_1^{-1}(-V_2, s_1, s_2) - \alpha_1 y}^{s_1 + \frac{\epsilon}{2}} (b_2 + \alpha_2 y + \frac{V_1(b_1 + \alpha_1 y, s_1, s_2) - V_2}{2}) f_1(b_1|s_1) db_1. \tag{5}$$

Proposition 1 characterizes the solution of the bargaining game for best responses $V_1(.)$ and $V_2(.)$ that are linear functions of the controlling shareholders' own valuations.

Proposition 1 *Suppose that the project's verifiable return is y, the private benefits of control are b_1 and b_2, and the signals of the private benefits are $s_i = b_i + \epsilon_i$ for $i \in \{1, 2\}$ and $\epsilon_i \in [-\frac{\epsilon}{2}, \frac{\epsilon}{2}]$. Then, there exists a Bayesian Equilibrium in which the investment will be undertaken if and only if*

$$b_1 + b_2 + (\alpha_1 + \alpha_2)y \geq \frac{1}{4}\{s_1 + s_2 + (\alpha_1 + \alpha_2)y + \epsilon\}. \tag{6}$$

It is easy to show that the investment policy of the controlling shareholders rejects projects that are in their collective interest. The left-hand side of the investment rule (equation (6)) is the combined valuation of the controlling shareholders. In the absence of bargaining problems, a project will be undertaken if and only if the combined valuation is positive, that is, $b_1 + b_2 + (\alpha_1 + \alpha_2)y \geq 0$. Under imperfect information, however, the project will be accepted only if the combined valuation exceeds $\frac{1}{4}\{s_1 + s_2 + (\alpha_1 + \alpha_2)y + \epsilon\}$. Using $s_i = b_i + \epsilon_i$, this decision rule can be re-written as

$$b_1 + b_2 + (\alpha_1 + \alpha_2)y \geq \frac{1}{3}(\epsilon - \epsilon_1 - \epsilon_2).$$

Since ϵ_i is uniformly distributed in the interval $[-\frac{\epsilon}{2}, \frac{\epsilon}{2}]$, $\epsilon - \epsilon_1 - \epsilon_2$ is strictly positive

[8] It can be shown that, in any Bayesian Equilibrium, the functions $V_1(.)$ and $V_2(.)$ increase with the valuation of the project. If these functions are not strictly increasing, $V_i^{-1}(x)$ should be understood as the minimum valuation of the project that makes the controlling shareholder i announce x.

with probability 1. Hence, the controlling shareholders will pass up projects that are in their collective interest if the payoffs satisfy $0 < b_1 + b_2 + (\alpha_1 + \alpha_2)y < \frac{1}{3}(\epsilon - \epsilon_1 - \epsilon_2)$. We have thus shown that

Proposition 2 *With shared control, the controlling shareholders will not undertake projects that are against their collective interest. They may pass up, though, projects that would have increased the sum of their expected payoffs.*

The intuition for Proposition 2 is straightforward. Both controlling shareholders have incentives to shade their valuations for the project. After all, the transfer paid by the initial shareholder increases with his announcement of the project's value, V_1, and decreases with the other controlling shareholder's announcement, V_2. Shading the valuations increases the chances that the project is not undertaken. Bargaining under imperfect information, therefore, biases the investment decision against the undertaking of the project.

C The costs and benefits of sharing control

Rejecting projects that are in the collective interest of the controlling shareholders is not always inefficient. If the verifiable return y is negative, the separation between ownership and control (i.e., $\alpha_1 + \alpha_2 < 1$) may imply that an inefficient project is profitable for the controlling shareholders, that is, $b + y < 0$ and $b + (\alpha_1 + \alpha_2)y > 0$. Thus, ex-post bargaining problems among the controlling shareholders may mitigate overinvestment problems.

Disagreements among the controlling shareholders are not the only reason for why shared control may increase value. The proceeds from the sale of a control stake enable the initial shareholder to finance projects, with fewer minority shares. If the verifiable return y is positive, a larger control stake may induce the controlling group to undertake efficient projects that a single controlling shareholder would reject.[9] Hence, sharing control may increase value, for two reasons: ex-post bargaining problems that curb overinvestment problems, and a larger control stake that reduces underinvestment problems.

[9] One could think that a larger control stake might exacerbate the overinvestment problem when the verifiable return, y, is positive. That cannot happen, though. To see this, note that, for $y > 0$, the project will be accepted under shared control if and only if $b + (\alpha_1 + \alpha_2)y > 0$. But then $y > 0$ and $\alpha_1 + \alpha_2 \leq 1$ imply that $b + y > 0$. In summary, a larger control stake increases the chances that multiple controlling shareholders undertake the project only if the latter is efficient.

Unfortunately, ex-post bargaining problems may also lead to the rejection of efficient projects. That will be the case if $b + y > 0$ but $b + (\alpha_1 + \alpha_2)y < \frac{1}{3}(\epsilon - \epsilon_1 - \epsilon_2)$. Shared control thus implies two conflicting effects on the magnitude of the underinvestment problem. On the one hand, its larger control stake makes the controlling group internalize the firm's value to a greater extent, reducing the incentives to underinvest. On the other hand, ex-post bargaining problems may imply the rejection of efficient projects. If the former effect prevails, shared control is surely efficient because it mitigates both underinvestment and overinvestment problems.[10] If the latter effect prevails, however, shared control implies a trade-off between the benefits of curbing overinvestment problems and the costs of exacerbating underinvestment problems. As such, one would expect that firms with more severe overinvestment problems should benefit the most from sharing control.

Proposition 3 formalizes this intuition. In doing so, we group the states of nature in which a project is inefficient in a set with probability Π, while the efficient projects belong to a set with probability $1 - \Pi$. As Proposition 3 shows, sharing control unambiguously increases firm value if the probability Π that the project is inefficient is large enough. Accordingly, shared control should be more pervasive in firms with overinvestment problems. Proposition 3 formalizes this intuition.[11]

Proposition 3 *Let Π be the probability that the project is inefficient. Moreover, consider the comparative statics problem where Π changes while maintaining everything else fixed, including the optimal stake of a single controlling shareholder. Then, there exists a probability $\hat{\Pi}$ such that sharing control increases firm value if $\Pi \geq \hat{\Pi}$. Shared control is thus optimal when overinvestment problems are likely to occur.*

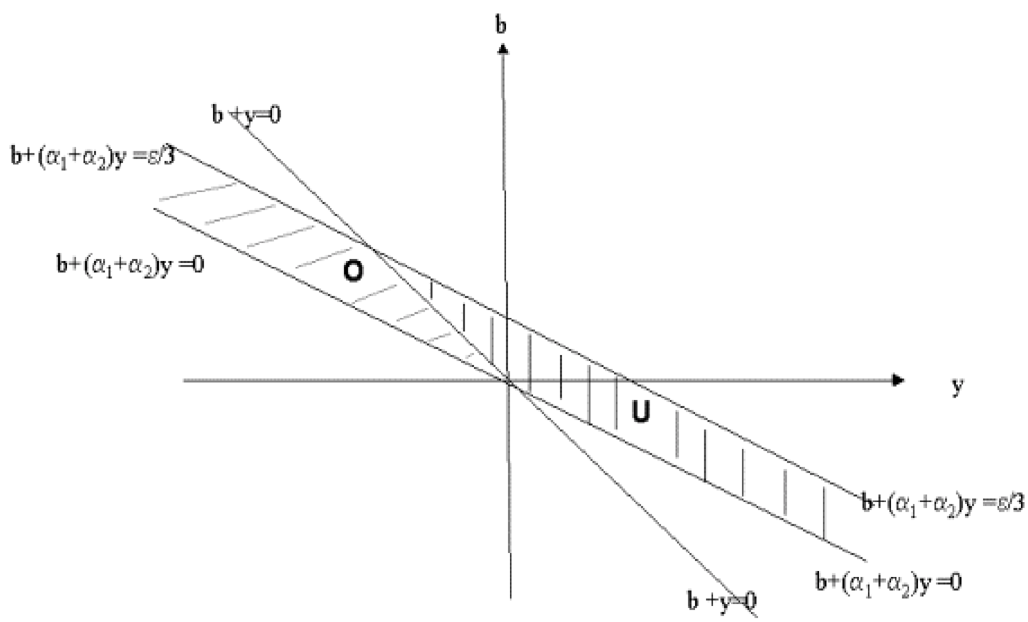
Figure 2 illustrates Proposition 3 in the worst case scenario (for shared control) that the equity stake of the controlling shareholders is equal to the optimal equity stake of a single

[10] In fact, sharing control achieves the first best if the project is certain to be inefficient and the control stake is $\alpha_1 + \alpha_2 = 1$.

[11] In Proposition 3, the comparative statics assumes that the optimal stake of a single controlling shareholder remains constant when the probability Π that the project is inefficient changes. This assumption can be justified as follows. Although our model rules out any discretion on the scale of the project, controlling shareholders often scale down projects in response to a worst business environment. Our model may capture this optimal response by assuming that the investment requirement I decreases with the probability Π. If, in addition, we assume that I changes so that the equity stake of a single controlling shareholder remains constant, we fix the ownership structure under a single controlling shareholder and focus the sharing control decision on the trade-off between the underinvestment and the overinvestment problems.

controlling shareholder. In the figure, the space above the 45 degree line ($b + y = 0$) describes the payoffs of efficient projects. In turn, the space above the line $b + (\alpha_1 + \alpha_2)y = 0$ describes the projects (payoffs) that would be undertaken had a single controlling shareholder with an equity stake $\alpha_1 + \alpha_2$ had full control over the investment decision. Hence, the area under $b + y = 0$ and above $b + (\alpha_1 + \alpha_2)y = 0$ characterizes the single shareholder's incentives to overinvest. For $b > 0$, the project may be inefficient, $b + y < 0$, and yet the single controlling shareholder undertakes it to increase the private benefits, $b + (\alpha_1 + \alpha_2)y > 0$. In contrast, the area under $b + (\alpha_1 + \alpha_2)y = 0$ and above $b + y = 0$ represents the single shareholder's incentives to underinvest. For $b < 0$ and $b + (\alpha_1 + \alpha_2)y < 0$, the single controlling shareholder will forego efficient projects to avoid the loss of private benefits.

Figure 2: Investment decisions with shared control.



Once control is shared, the condition for accepting a project changes from $b+(\alpha_1+\alpha_2)y \geq 0$ to $b+(\alpha_1+\alpha_2)y \geq \frac{1}{3}(\epsilon - \epsilon_1 - \epsilon_2)$. (Assuming that the control stake remains the same). The higher hurdle blocks some efficient projects. In fact, it may prevent efficient projects that a single controlling shareholder would undertake, reducing firm value accordingly. If the realizations of the signals equal the true private benefits (i.e., $\epsilon_i = 0$ for $i \in \{1, 2\}$), these projects are characterized by the region U (for underinvestment) in figure 2. Yet, the higher hurdle may also prevent inefficient projects that a single controlling shareholder would undertake. These projects are described by the area below $b+y=0$ and $b+(\alpha_1+\alpha_2)y = \frac{1}{3}\epsilon$, and above $b+(\alpha_1+\alpha_2)y = 0$ (marked O in figure 2).

Clearly, the net benefits of sharing control depend on whether the payoffs of the project are more likely to lie on regions U or O. As the probability Π that the project is inefficient increases, so do the chances that the realized payoffs lie on the region O. In fact, in the polar case that Π converges to 1, the region U becomes irrelevant and the net benefits of sharing control collapse to the gains of curbing overinvestment problems (region O). Sharing control is then certain to be efficient.

While Proposition 3 gives us a sufficient condition for the efficiency of shared control – significant overinvestment problems –, firm characteristics determine the weakest overinvestment problem that induces an initial shareholder to share control. As Proposition 4 shows, the level of financing requirement is one example of a firm characteristic that plays an important role in the efficiency of shared control as a governance mechanism.

Proposition 4 *The efficiency of the shared control mechanism does not depend on the level of financing requirement (I) while the value of firms with a single controlling shareholder decreases with the level of financing requirement. The benefits of sharing control thus increase with the level of financing requirement.*

The intuition for Proposition 4 is quite simple. When the investment requirement increases, a single controlling shareholder must sell a larger amount of minority shares to finance the project. The lower control stake makes the initial shareholder internalize a smaller fraction of the firm's value, increasing his incentives to distort the investment policy. Firm value, therefore, decreases with the investment requirement.

In contrast, a larger financing requirement does not imply a reduction of the control stake under shared control. The initial shareholder can raise extra funds by selling more of his control shares to the other controlling shareholder, while keeping the control stake constant. By doing so, the initial shareholder can not only finance a larger investment requirement but also obtain funds to afford side payments in the bargaining over the investment decision.

In summary, while firms under a single controlling shareholder experience a decrease in value when the financing requirement increases, sharing control insulates the firm's value from the investment requirement. The net benefits of sharing control thus increase with the financing requirement for any probability Π that the project is inefficient.

III The Role of Large Shareholders in Corporate Governance

Sharing control is not the only mechanism available to prevent inefficient investment decisions that harm minority shareholders. Since Grossman and Hart (1980) and Shleifer and Vishny (1986), a large literature on corporate control has described the efficiency gains of letting outside investors monitor the control group. In this section, we introduce monitoring in the model, contrasting it with shared control. We shall show that these two control mechanisms imply different investment policies, providing a sufficient condition for sharing control to dominate monitoring as a governance mechanism.

A Introducing monitoring

Assume that, at a private cost $c(m) = \frac{\rho m^2}{2}$, an outside investor assures a probability $m \in [0, 1]$ that the court will overturn an investment decision that is against the interest of the minority shareholders. More precisely, if the investment decision calls for the undertaking of a project with negative verifiable returns (e.g., a value-decreasing acquisition driven by empire building concerns), then the minority shareholders' expected benefit of monitoring is $-my$. Likewise, the expected benefit of forcing the undertaking of a project with positive return (e.g., filing a law suit to redeem a poison pill that prevents a value-enhancing takeover) is my. We can thus write the minority shareholders' expected benefits of monitoring as $m|y|$.

The cost of monitoring should be interpreted as follows. Although verifying y can be costless after the cash flows realize, convincing the court to overturn an investment decision requires information on the project's returns before their realization. We assume that gathering this information is costly and that the cost $c(m)$ increases with the probability m of overturning the investment decision. The cost of monitoring also depends on the nature of the investment. For instance, evaluating a project with a high volatility of verifiable returns (e.g., an R&D project) is likely to be more difficult than a typical project. Courts should then be more reluctant to overturn a management's decision related to an R&D project. The parameter $\rho > 0$ in the cost function captures the relation between the volatility of the returns and the cost of monitoring; the larger the volatility is, the larger the value of ρ.

The cost of monitoring induces a free-rider problem. As Grossman and Hart (1980) point out, while the monitor bears the cost $c(m)$, the gains of overturning an investment decision is spread over all the minority shareholders. The incentives to monitor thus increase with the monitor's equity stake. More formally, a monitor with an equity stake $\beta \in (0,1)$ chooses the level of monitoring m by solving

$$\max_{\{m \in [0,1]\}} \beta m|y| - \frac{\rho m^2}{2}. \tag{7}$$

Equation 7 assumes that the return y is observable by the monitor but not costlessly verifiable by the court. Solving the above maximization problem yields $m(\beta, \rho, |y|) = min\{\frac{\beta}{\rho}|y|, 1\}$. As expected, the incentives to monitor increase with the equity stake, β, and decrease with the parameter ρ that captures the cost of verifying y. As such, the effectiveness of monitoring as a mechanism to discipline controlling shareholders depends on these two parameters.

Note, however, that effective monitoring is not necessarily efficient. As Burkart, Gromb, and Panunzi (1997) point out, an outside monitor may overturn investment decisions that increase the firm's value but harm the minority shareholders. For instance, monitoring will be inefficient if the control group decides to undertake a value enhancing project that harms the minority shareholders, i.e., $b + y > 0$ but $y < 0$. Likewise, value is decreased if a monitor tries to force the control group to undertake a project whose positive verifiable return comes at a cost of a large loss of private benefits.

The initial shareholder's decision of selling a block stake for an outside monitor thus depends not only the cost of monitoring (ρ) but also on the extent that the interests of minority shareholders are aligned with the firm's value. As the next section shows, sharing control is likely to dominate monitoring as a governance mechanism in firms with large overinvestment problems and in firms whose cash flows are hard to verify.

B Sharing control versus monitoring

In the corporate control literature, monitoring is viewed as a mechanism to protect shareholders who do not have a direct participation in the firm's management. In our paper, shared control plays the same role. As such, one might wonder whether these two mechanisms are redundant.

As it turns out, monitoring and shared control are not redundant. In fact, these two control mechanisms have opposite biases with respect to investment decisions. While shared control leans toward preserving valuable private benefits of control, monitoring emphasizes verifiable cash flows. As a result, the two mechanisms will be, at times, complementary.

To see that shared control and monitoring may play complementary roles, consider first that shared control leads to an overinvestment problem: $b + y < 0$ but $b + (\alpha_1 + \alpha_2)y > \frac{1}{3}\{\epsilon - \epsilon_1 - \epsilon_2\}$. Since the hurdle for investing in the project under shared control is strictly positive with probability 1 ($\frac{1}{3}\{\epsilon - \epsilon_1 - \epsilon_2\} > 0$), overinvestment may happen only if the joint presence of minority and controlling shareholders ($\alpha_1 + \alpha_2 < 1$) implies that the latter do not fully internalize a negative verifiable return. A negative verifiable return, however, will trigger a monitor's effort to block the investment decision. Monitoring, therefore, mitigates overinvestment problems that shared control cannot curb.

Likewise, monitoring may play a value-enhancing role when shared control implies underinvestment: $b + y > 0$ but $b + (\alpha_1 + \alpha_2)y < \frac{1}{3}\{\epsilon - \epsilon_1 - \epsilon_2\}$. Monitoring increases value if the interests of the minority shareholders are aligned with firm value ($b + y > 0$ and $y > 0$), because a monitor will try to force the controlling group to undertake the project. However, note that, if the verifiable return is negative ($y < 0$), monitoring will not curb the distorted incentives of the controlling group, as outside shareholders will actually benefit from the inefficient investment decision.

Unfortunately, monitoring may also increase inefficiency under shared control. For instance, the controlling group may decide to undertake an efficient project, $b + (\alpha_1 + \alpha_2)y > \frac{1}{3}(\epsilon - \epsilon_1 - \epsilon_2)$, whose verifiable return y is negative. A monitor with equity stake β would then spend $c(m(\beta, \rho, |y|))$ to stop the project. In addition, a monitor may try to force the control group to undertake an inefficient project if $y > 0$. An ownership structure with an outside monitor, therefore, is not necessarily optimal.

Proposition 5 provides a sufficient condition for monitoring to be sub-optimal. Firms with a large probability of overinvestment problems should not allow for an outside monitor if there is a positive probability that the interests of the minority shareholders are not aligned with the firm's value. In this case, sharing control approaches the first best, while monitoring is always inefficient.

Proposition 5 *Assume that* $Prob(b+y < 0, y > 0) > 0$ *and* $Prob(b+y < 0, \alpha y+b > 0) > 0$ *for any control stake* $\alpha \in [0, 1)$. *Then an optimal ownership structure includes multiple controlling shareholders and no outside monitor if the probability* Π *that the project is inefficient is greater than or equal to some* $\hat{\Pi} \in [0, 1)$.

The intuition of Proposition 5 is quite simple. If the probability Π that the project is inefficient is large enough, ex-post bargaining problems curb overinvestment without a significant increase of the underinvestment problem. Indeed, for $\Pi = 1$, Proposition 2 implies that ex-post bargaining problems will, at most, induce the controlling shareholders to pass up an inefficient project. Hence, the first best is achieved by making the controlling shareholders full residual claimants on the firm's value. In contrast, monitoring (with or without multiple controlling shareholders) introduces the possibility that the outside monitor convinces the court to force the controlling group to undertake an inefficient project with a positive verifiable return.

Firms with a large probability of overinvestment are not the only ones that should avoid outside monitors. The net gains of monitoring decrease with the cost ρ of verifying the return y. The larger ρ is, the higher the cost of convincing the court to overturn a business decision. Monitoring is thus unlikely to be an efficient corporate control mechanism in firms whose cash flows are hard to verify (high values of ρ).

In contrast, the court's ability to verify cash flows does not affect the effectiveness of sharing control as a corporate control mechanism. In fact, our model assumes that, at the moment that the investment decision is made, the controlling shareholders know the verifiable return y. In other words, sharing control keeps the investment decision in the hands of insiders, who have an informational advantage over the court (or any other outsider) in evaluating the project. Accordingly, sharing control should prevail in firms whose cash flows are hard to verify even if overinvestment problems are not too severe. In these firms, large shareholders should have a direct participation in the firm's management.

In section V, we describe a way to test this implication. Before doing that, however, section IV discusses the stability and robustness of an ownership structure with multiple controlling shareholders. As we shall argue, shareholders' agreements and supermajority rules play an important role in implementing ownership structures with multiple controlling shareholders, making them robust to the possibility of retrading.

IV Implementing Shared Control

At least three problems make it difficult to implement an ownership structure with multiple controlling shareholders. First, a controlling group has ex-post incentives to reduce an ex-ante optimal controlling stake. Second, some of the controlling shareholders may try to form a coalition to exclude the controlling shareholders who oppose their favorable policies. Finally, the same bargaining problems that discipline the controlling group create incentives for one of the controlling shareholders to buyout the whole control stake. This section shows how supermajority rules and shareholders' agreements assure the robustness of the optimal ownership structure with respect to these three problems.

A Ex-post incentives to trade and supermajority rules

Since a lower equity stake makes the controlling group internalize more of the private benefits of control and less of the firm's verifiable cash flows, a reduction in the control stake should be followed by a drop in stock prices. This stock price reaction curbs some of the controlling shareholders' desire to reduce their equity stake. Yet, while a drop in the equity value will be shared with the minority shareholders, the controlling shareholders will capture all of the increase in private benefits that ultimately explains the lower equity value. The stock price reaction, therefore, does not fully curb ex-post incentives for lowering the control stake. As we now argue, supermajority rules can prevent these ex-post incentives from breaking down an ex-ante optimal control stake.

Suppose that the optimal ownership structure requires the controlling group hold a fraction $\alpha^\star$ of the firm's shares. For a given voting structure, the stake $\alpha^\star$ is associated with a number of votes, say v. The initial shareholder can avoid ex-post incentives to reduce the controlling stake below $\alpha^\star$ by giving control to a group of investors who holds a fraction v of the votes. With this supermajority rule, the controlling shareholders cannot divest below v without bearing the risk of losing control. Moreover, incentives to dilute the minority shareholders assure that the controlling shareholders do not have ex-post incentives to hold more than the optimal threshold v. We conclude that a properly designed supermajority rule prevents ex-post incentives to trade from breaking down an optimal ownership structure with multiple controlling shareholders.

B Coalition games and shareholders' agreements

In principle, a member of a controlling group may be co-opted to participate in a new coalition that aims to defeat the incumbent controlling group. Bennedsen and Wolfenzon (2000) argue that the size of the controlling stake is determined by these coalition games. The optimal ownership structure might then fail to be implementable because it does not take into account the possibility of new coalitions.

Shareholders' agreements may prevent exclusions and defections that could unravel the controlling group. For instance, pooling agreements (also called voting agreements) assure that each member of the agreement will nominate a certain number of candidates for the board of directors. (In most cases, the participants of the agreement must cast their votes in the group's nominees.) Based on the number of votes of each controlling shareholder, a supermajority provision can be chosen to give veto power to each member of the group, avoiding their exclusion and blocking the formation of new coalitions. Finally, buyout agreements give group members the right to veto the sale of controlling shares to undesirable investors.

Unfortunately, we do not have data on the use of shareholders' agreements in the U.S.[12] In Italy, however, the CONSOB (the Italian equivalent of the SEC) discloses the shareholders' agreements of all public firms. Table 1 shows that, as of December 1996, 58 of the 303 Italian firms with listed shares (i.e., 19.1 percent) had some type of shareholder agreement. Restrictions on the sale of shares (buyout agreements) are the most common ones (17.2 percent),

[12] Nonetheless, corporate law books (e.g., O'Neal and Thompson, 1992) and Black and Gilson (1997) report that shareholders' agreements are often present in close corporations and in the venture capital industry, respectively.

followed by voting agreements (12.8 percent), and control agreements that establish policies for the firm (6.6 percent). In interpreting the data, though, one should take into account that most Italian public companies have a majority shareholder. Fulghieri and Zingales (1995) report that, in 1990, 53 percent of the firms listed in the Milan Stock Exchange (by far Italy's largest) had a majority shareholder. Assuming that 53 percent of the firms in the CONSOB database also have a majority shareholder, and that these firms do not have shareholders' agreements (they do not need them), then the fraction of firms with no majority shareholder that have a shareholders' agreement would go up to 40.7 percent.

From table 1, one can also see that the median percentage of shares participating in all types of agreements is larger than 50 percent but less than 51 percent. Hence, the group participating in the agreement has the majority of the votes. Shareholders' agreements in Italy seem to be ensuring the stability of control groups with the minimum number of votes needed to retain control.

C Dissolving the controlling group

Nothing prevents one of the controlling shareholders from making an offer to acquire full control. In fact, a buyout seems a natural mechanism to eliminate bargaining problems that, although ex-ante optimal, are ex-post inefficient from the perspective of the controlling shareholders. To assess this possibility, consider that any controlling shareholder can make a buyout offer date between the time that they learn their valuations of the project and the time that the investment decision has to be made. We ask whether there is an incentive compatible direct mechanism that lets the controlling shareholders dissolve their partnership with probability 1. If so, ex-post bargaining problems can be solved by a buyout, and the temporary presence of multiple controlling shareholders would not increase value.

Proposition 6 shows that the same asymmetry of information that prevents the controlling shareholders from efficiently agreeing on the investment decision will prevent them from acquiring full control, even if they had the funds to do so.

Proposition 6 *(Dissolving the controlling group) Assume that controlling shareholder j receive a signal s_i of the private benefits of controlling shareholder $i \neq j$, with $\underline{b}_i = s_i - \frac{\epsilon}{2}$, $\bar{b}_i = s_i + \frac{\epsilon}{2}$, and $\sum_{i=1}^{2}(\underline{b}_i + \alpha_i y) < 0 < \sum_{i=1}^{2}(\bar{b}_i + \alpha_i y)$. Then there is no ex-post efficient* *mechanism that dissolves the controlling group after the controlling shareholders have privately learned their valuations.*

This result departs from Cramtom, Gibbons, and Klemperer (1987), who argue that a partnership can always be efficiently dissolved if its equity holdings are evenly spread across several partners. (Proposition 6 can be generalized to more than two controlling shareholders.) The way we model the private benefits of control is the key to explaining the difference in the results. In Cramtom, Gibbons, and Klemperer, the value of the firm to each controlling shareholder is proportional to the fraction of shares that they own. As a result, in an evenly distributed ownership structure, the cost of extracting a truthful announcement of the firm's value decreases with the number of controlling shareholders. In our model, a controlling shareholder may have large private benefits of control in spite of an evenly distributed ownership structure.

V Evidence and Discussion

A Ownership structure of close corporations in the U.S.

In a recent paper, Ang, Cole, and Lin (2000) use the National Survey of Small Business Finances (NSSBF) of 1992 to study the interaction between ownership structure and agency costs. The NSSBF provides ownership and financial data on 4,637 for-profit, non-financial businesses with less than 500 employees (the database includes neither subsidiaries nor farm businesses). In this sample, Ang, Cole, and Lin (2000) show that firms whose managers are also shareholders have a 5.4 percent lower ratio of operating expenses over total assets than firms whose managers do not own equity in the firm. The authors interpret their finding as evidence that management's equity reduces agency costs.

Conflicts between managers and shareholders are not the only source of agency costs, though. As our paper – among others – points out, controlling shareholders may force outside managers to act against the interests of the minority shareholders. In fact, these agency costs should be particularly important in firms whose manager is also a large shareholder. After all, a manager who does not internalize the private benefits of control represents a well informed outsider who might substantiate to a court claims of self interested behavior in business decisions. As such, class actions should impose a more powerful threat in these firms, constraining the actions of the controlling groups accordingly.

Yet, the findings of Ang, Cole, and Lin (2000) suggest that, among close corporations in the U.S., managerial agency costs prevail over agency costs against the minority shareholders. This section provides evidence that the presence of multiple large shareholders, which reduces agency costs against the minority shareholders, may explain the greater importance of managerial agency costs in close corporations.

As in Ang, Cole, and Lin (2000), our starting point is the sample of 4,637 firms in the NSSBF database. From this initial sample, we restrict attention to the 310 close corporations with annual sales above $10 million that had more than one shareholder. We focus on the close corporations because a vast literature on corporate law describes bargaining problems involving shareholders in these firms. We thus believe that they constitute a good sample to examine for the ownership incentives that this paper emphasizes.

The first column of table 2 presents summary statistics of our sample. From the 310 firms, it is inferred that, as of 1992, there existed 64,708 close corporations in the U.S. with more than one shareholder and annual sales above $10 million. The estimate of the average sales of these 64,708 close corporations is $23.3 million, while the average asset value and the average number of employees are estimated at $7.5 million and 98.0, respectively. The distribution of shareholders in the close corporations is highly skewed. Although the average number of shareholders is 74.4, the median is only 3.0 (31.2 percent of the firms have 2.0 shareholders and 18.8 percent have 3.0 shareholders).

Firms participating in the survey report, among other things, the ownership stake of the principal shareholder, who is not necessarily the largest one, and the total number of shareholders.[13] Unfortunately, the database does not provide information on the number of shares held by shareholders other than the principal one. Nonetheless, we can obtain a lower and an upper bound on the equity holdings of, respectively, the second largest and the smallest shareholder by computing the average equity stake of the shareholders other than the principal one. We use these bounds to infer the ownership structure of the close corporations in the sample.

[13] According to the NSSBF questionnaire, the principal shareholder is "typically the owner who has the largest ownership share and has the primary authority to make financial decisions."

Following La Porta, Lopez-de-Silanes, and Shleifer (1999), we say that a firm has a large shareholder if there is a shareholder with more than 20 percent of the shares. A firm has multiple large shareholders if the largest shareholder has more than 20 percent of the shares while a second one has at least 10 percent. In implementing these criteria, we classify a firm as having multiple large shareholders if the equity stake of the principal shareholder and the average equity stake of the remaining ones are both larger than 10 percent, with at least one of them above 20 percent.[14] A firm has only one large shareholder if the maximum between the equity holdings of the principal one and the average of the other equity stakes is above 20 percent while the minimum is below 10 percent. Finally, we say that a firm has minority shareholders if there is no large shareholder or if there is a shareholder whose equity holdings are half of the equity holdings of the largest shareholder. We implement this latter condition by requiring that either the equity holdings of the principal shareholder are twice the average equity holdings, or vice versa.[15]

The last five rows of table 2 provide summary statistics on the ownership structure of the close corporations. Not surprisingly, 86.9 percent of the firms have at least one large shareholder. Also, 67.7 percent of the close corporations have minority shareholders, while 54.7 percent (not reported in the table) of the firms with at least one large shareholder have minority shareholders as well. These numbers suggest that conflicts of interests between large and minority shareholders are potentially relevant. Contrary to the sample of La Porta, Lopez-de-Silanes, and Shleifer (1999), the majority of the firms with at least one large shareholder have other large shareholders (65.8 percent).[16]

We hypothesize that conflicts of interest between the controlling group and the minority shareholders are more relevant in firms where the manager is also a large shareholder. Hence, multiple large shareholders should be more often present in these firms.[17] Indeed, table 2

[14]This criterion biases the results against finding multiple large shareholders because the average equity stake may be below 10 percent even if there exists a shareholder other than the principal one with more than 10 percent of the shares.

[15]The idea here is that having at least twice the equity stake of another shareholder gives a strong bargaining power to the largest shareholder. The requirement goes both ways because the principal shareholder is not necessarily the largest one.

[16]In a sample of public firms in 27 countries, La Porta, Lopez-de-Silanes, and Shleifer (1999) find that only 25 percent of the firms that are controlled by a large shareholder have other large shareholders.

[17]If all the large shareholders belong to the controlling group, their presence will create bargaining costs that protect the minority shareholders. Otherwise, at least one of the large shareholders will monitor the controlling group, protecting the interests of the minority shareholders.

shows that 24.9 percent of the close corporations whose manager is not a shareholder have multiple large shareholders. Moreover, conditioned on the presence of a large shareholder, the probability that another larger shareholder exists is 36.1 percent. In contrast, 69.4 percent of the close corporations where the manager is also a shareholder have multiple large shareholders. Conditioned on the existence of a large shareholder, the probability that there exists another large shareholder is 74.0 percent.

In an attempt to tie the presence of multiple large shareholders to the protection of the minority ones, we also compute the probability of finding multiple large shareholders conditioned on the joint presence of a large shareholder and minority ones. The last row in table 2 shows that this probability is substantially smaller for firms whose manager is not a shareholder (20.7 percent compared to 55.2 percent for firms whose manager is also a shareholder).[18] This very coarse look at the ownership structure of close corporations in the U.S., therefore, suggests that the presence of multiple large shareholders is associated with the protection of minority shareholders. Yet, the data cannot tell us whether the presence of multiple large shareholders reflects monitoring or sharing control. The next subsection shows how to empirically distinguish these two cases.

B Testing the determinants of shared control

A main result of this paper is that, regardless of their role, the presence of multiple large shareholders protects the minority ones. If all the large shareholders directly participate in the firm's management, bargaining problems may prevent business decisions that would be costly for the minority shareholders. If one or more large shareholders are out of the controlling group, their equity stakes elicit incentives for them to monitor the business decisions, constraining the controlling group's ability to dilute minority shareholders.

Still, whether large shareholders participate in the management or limit themselves to monitor the controlling group has important implications for corporate governance. For instance, to reduce rent-seeking behavior, corporate law in the U.S. constrains a shareholder's

[18] Since 67.6 percent of the firms in the sample are classified as family-controlled, the difference in the conditional probabilities could be driven by some characteristic of family businesses that the presence of a manager owner captures. Nonetheless, the magnitude of the difference in the conditional probabilities in the two subsamples remains unchanged when we exclude the family-controlled firms from the sample.

ability to influence the management. Several changes have been proposed in the last 10 years to relax these limitations. Roughly, the intent of these changes is to increase shareholders' ability to monitor the management. As this and other papers have shown, however, enhancing the effectiveness of monitoring may be inefficient. In particular, making it more difficult for a controlling group to limit the monitoring of their activities may be value decreasing if mechanisms like shared control can protect the minority shareholders more efficiently.

Our model predicts that multiple controlling shareholders should be more often present in firms with overinvestment problems, high costs of verifying cash flows, and large financing requirements. One way to test this prediction is to pre-select a sample of firms with these characteristics and to test whether they are more likely to have multiple controlling shareholders.

Since the innovative nature of an R&D project makes it harder for an outsider to assess its profitability, firms with large investments in R&D probably constitute a good sample to look for shared control. As we have argued in the introduction, the SEC requires that firms with publicly traded securities disclose the existence of shareholders' agreements, making them available in their EDGAR database. The existence of shareholders' agreements in a firm can thus be used as a proxy for shared control. Hence, a testable implication of the model is that shareholders' agreements are more often found in firms with large R&D investments.

C Ownership structure and law

In countries that offer weak legal protection to minority shareholders, private benefits may be financed by the firm's cash-flow. If so, the private benefits are pecuniary and they should be negatively correlated to the firm's "public" cash-flow. We can easily incorporate this negative correlation into our model.

Still assuming that b is the total private benefits of control, let $y - kb$ be the project's return from the perspective of the minority shareholders, where $k \in [0, 1]$. In countries that offer weak protection to minority shareholders, k is strictly positive, reflecting the possibility that private benefits are financed by public cash-flows. If so, \$1 of private benefits imposes a direct loss of \$k to minority shareholders. In countries with strong legal protection to the minority shareholders, $k = 0$ and the private benefits of control are better interpreted as being nonpecuniary.

The major results of our paper can be extended to the case where $k > 0$. Sharing control still implies a trade-off between underinvestment and overinvestment costs. The effects of a weaker protection to minority shareholders (that is, a higher k) on the optimal ownership structure are ambiguous, though. On the one hand, $k > 0$ makes private benefits more costly to minority shareholders, increasing the costs of distorting the investment policy. Accordingly, the incentives for controlling groups to share control and introduce outside monitoring increase. On the other hand, a controlling shareholder's ability to capture public cash-flows increases the side payments that another controlling shareholder might request in exchange for not blocking the project. As a result, the probability of disagreement increases when $k > 0$. The larger underinvestment costs reduce the incentives for multiple controlling shareholders. The existence of two opposing effects, thus, prevents an unambiguous theoretical relation between a country's legal protection of minority shareholders (parameterized by k) and the optimal number of controlling shareholders.

An empirical study by La Porta, Lopez-de-Silanes, and Shleifer (1999) suggests that these two opposing effects cancel each other. Using a sample of firms in 27 countries, La Porta, Lopez-de-Silanes and Shleifer find that the probability that a controlling shareholder is alone in family-controlled public firms is 65 percent for the countries offering weak protection to minority shareholders, while the probability increases to 79 percent in the countries with stronger protection to minority shareholders. Nonetheless, the difference of means is not statistically significant (t-statistics equal to -1.31).

VI Conclusion

In the corporate finance literature, large shareholders are usually assumed to monitor managers on behalf of all shareholders. As La Porta, Lopez-de-Silanes, and Shleifer (1999) document, however, large shareholders often participate in the management. Accordingly, Pagano and Roell (1998) suggest that an optimal ownership structure may require multiple large shareholders: It takes a large shareholder to monitor a large shareholder in control. Yet, a vast literature on corporate law does not view large shareholders as monitoring each other on behalf of minority shareholders. Instead, large shareholders are perceived as decision makers who seek to influence corporate decisions in a way that favors their personal agendas.

This paper argues that firm characteristics determine the role that large shareholders play in corporate governance. In firms with severe underinvestment problems, sharing control creates bargaining problems that exacerbate the risk of corporate paralysis. Control should not be divided, and, as in the corporate finance literature, monitoring by a large outside investor arises as the most efficient way to protect minority shareholders. In contrast, sharing control increases efficiency in firms with severe overinvestment problems. In these cases, multiple large shareholders should participate in the firm's management. Since bargaining problems within the controlling group protect the minority shareholders, the incentives for monitoring are reduced. Large shareholders, therefore, will more likely act as key decision-makers, as in the corporate law literature.

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Appendix

Proof of Proposition 1

Let $V_i(x_i, s_1, s_2)$ be the best announcement of controlling shareholder $i \in \{1,2\}$, where $x_i = b_i + \alpha_i y$ is controlling shareholder i's valuation of the project. To simplify the notation, we will henceforth omit the arguments s_1 and s_2 in $V_i(x_i, s_1, s_2)$. In addition, let $u_i \equiv s_i + \frac{\epsilon}{2} + \alpha_i y$ and $l_i \equiv s_i - \frac{\epsilon}{2} + \alpha_i y$ be, respectively, the upper and lower bounds of b_i given the signal s_i.

Standard arguments in the mechanism design literature show that, in any Bayesian equilibrium, $V_i(x_i)$ increases with the valuation of the project x_i. Moreover, Lemma 1, below, shows that the equilibrium announcements must satisfy a system of differential equations.

Lemma 1 *In any Bayesian equilibrium in which the best policies $V_1(x_1)$ and $V_2(x_2)$ are differentiable, the following linked differential equations holds:*

$$V_1^{-1}\left(-V_2\left(x_2\right)\right) + V_2\left(x_2\right) = \frac{1}{2}\frac{(1 - F_2(x_2))}{f_2(x_2)}V_2'\left(x_2\right) \tag{8}$$

$$V_2^{-1}\left(-V_1\left(x_1\right)\right) + V_1\left(x_1\right) = \frac{1}{2}\frac{(1 - F_1(x_1))}{f_1(x_1)}V_1'\left(x_1\right), \tag{9}$$

where $F_i(x_i)$ and $f_i(x_i)$ are, respectively, the distribution and the density of $x_i \equiv b_i + \alpha_i y$ conditioned on the signals s_1 and s_2.

Proof. Given V_1, the minimal announcement $V_2^\star$ that implies the undertaking of the project must satisfy $V_1 + V_2^\star = 0$. Since $V_2(x_2)$ increases with x_2, $V_2^\star$ induces a cutoff for the valuation x_2 of the second controlling shareholder: $V_1 + V_2(x_2^\star) = 0 \Rightarrow x_2^\star = V_2^{-1}(-V_1)$. The expected payoff of the initial shareholder given an announcement V_1 and a valuation x_1 is then equal to

$$\Pi_1(V_1, x_1) = \int_{V_2^{-1}(-V_1)}^{u_2} [x_1 - \frac{1}{2}(V_1 - V_2(x_2))] f_2(x_2) dx_2.$$

Assume first that any small perturbation from $V_1(x_1)$ affects the probability that the project will be undertaken. Then V_1 maximizes the expected payoff off the initial shareholder if and only if

$$\frac{\partial \Pi_1(V_1, x_1)}{\partial V_1} = -\left(x_1 - V_1\right) f_2(V_2^{-1}\left(-V_1\right))\frac{dV_2^{-1}\left(-V_1\right)}{dV_1} - \frac{1}{2}\int_{V_2^{-1}(-V_1)}^{u_2} f_2(x_2) dx_2 =$$

$$= \frac{(x_1 - V_1)\, f_2(V_2^{-1}(-V_1))}{V_2'\left(V_2^{-1}(-V_1)\right)} - \frac{1}{2}\left(1 - F_2(V_2^{-1}(-V_1))\right) = 0$$

Since $x_2^\star = V_2^{-1}(-V_1)$, the above equation can be rewritten as

$$(x_1 + V_2(x_2^\star)) - \frac{1}{2}\frac{(1 - F_2(x_2^\star))}{f_2(x_2^\star)} V_2'(x_2^\star) = 0 \tag{10}$$

If V_1 is an optimal response, $V_1 + V_2(x_2^\star) = 0$ implies that the initial shareholder's valuation, $x_1^\star$, that led to V_1 solves $V_1(x_1^\star) + V_2(x_2^\star) \Rightarrow x_1^\star = V_1^{-1}(-V_2(x_2^\star))$. Plugging $x_1^\star$ into equation (10) yields equation (8):

$$V_1^{-1}(-V_2(x_2^\star)) + V_2(x_2^\star) - \frac{1}{2}\frac{(1 - F_2(x_2^\star))}{f_2(x_2)} V_2'(x_2^\star) = 0.$$

The proof that equation (9) holds when any small perturbation of V_2 affects the chances that the project will be undertaken is analogous. Hence, suppose now that a perturbation of $V_1(x_1)$ does not change the probability that the project will be undertaken. This can happen in two cases. First, x_1 may be so large that, given $V_1(.)$ and $V_2(.)$, the project will be undertaken regardless of the announcement of the second controlling shareholder. In this case, there exists $x_2^\star \in [l_2, u_2)$ such that $V_1(l_1) + V_2(x_2^\star) = 0$. Still, the differential equation governing the optimal announcement of the initial shareholder remains unchanged, as we show below.

$$\Pi_1^\star(V_1, x_1) = \int_{V_2^{-1}(-V_1)}^{x_2^\star} [x_1 - \frac{1}{2}(V_1 - V_2(x_2))] f_2(x_2) dx_2 + \int_{x_2^\star}^{u_2} [x_1 - \frac{1}{2}(V_1 - V_2(x_2^\star))] f_2(x_2) dx_2.$$

$$\begin{aligned}
\frac{\partial \Pi_1^\star(V_1, x_1)}{\partial V_1} &= -(x_1 - V_1)\, f_2(V_2^{-1}(-V_1)) \frac{dV_2^{-1}(-V_1)}{dV_1} - \frac{1}{2}\int_{V_2^{-1}(-V_1)}^{x_2^\star} f_2(x_2) dx_2 - \frac{1}{2}\int_{x_2^\star}^{u_2} f_2(x_2) dx_2 \\
&= \frac{(x_1 - V_1)\, f_2(V_2^{-1}(-V_1))}{V_2'\left(V_2^{-1}(-V_1)\right)} - \frac{1}{2}\left(1 - F_2(V_2^{-1}(-V_1))\right) = 0,
\end{aligned}$$

which is exactly the same first order condition that we obtained before.

The second boundary case happens when the valuation of a controlling shareholder is so low that it blocks the project regardless of the announcement of the other controlling shareholder. To characterize this situation, let $x_1^{\star\star}$ be the minimum valuation of the initial shareholder when the second controlling shareholder's announcement is as large as possible, that is, $V_2(u_2)$. Then, $V_1(x_1^{\star\star})+V_2(u_2)=0$, and the project will not be undertaken for any $x_1 < x_1^{\star\star}$. Since the project will not be undertaken, the announcement of the initial shareholder is irrelevant. It is then optimal to set $V_1(x_1)$ satisfying equation (8) for $x_1 < x_1^{\star\star}$ with the understanding that the project will not be undertaken. Similarly, $V_1(u_1)+V_2(x_2^{\star\star})=0$ implies that the project will not be undertaken for $x_2 < x_2^{\star\star}$, and we can assign $V_2(x_2)$ satisfying equation (9).

□

The proof of the Proposition follows from equations (8) and (9). Conditioned on s_i, b_i is uniformly distributed in the interval $[l_i - \alpha_i y, u_i - \alpha_i y]$. Standard computations then show that, conditioned on s_i, the hazard rate of the random variable $x_i \equiv b_i + \alpha_i y$ is $\frac{(1-F_i(x_i))}{f_i(x_i)} = u_i - x_i$. Plugging this hazard ratio into equations (8) and (9) yields

$$\begin{aligned} V_1^{-1}\left(-V_2\left(x_2\right)\right) &= \frac{1}{2}\left(u_2 - x_2\right)V_2'\left(x_2\right) - V_2\left(x_2\right) \\ V_2^{-1}\left(-V_1\left(x_1\right)\right) &= \frac{1}{2}\left(u_1 - x_1\right)V_1'\left(x_1\right) - V_1\left(x_1\right). \end{aligned}$$

Assume now that there is a solution for the above system of differential equations that is linear in the valuation x_i, that is, $V_1(x_1) = Ax_1 + B$ and $V_2(x_2) = Cx_2 + D$. Thus

$$\begin{aligned} V_1^{-1}\left(-\left(Cx_2 + D\right)\right) &= \frac{1}{2}\left(u_2 - x_2\right)C - \left(Cx_2 + D\right) \\ V_2^{-1}\left(-\left(Ax_1 + B\right)\right) &= \frac{1}{2}\left(u_1 - x_1\right)A - \left(Ax_1 + B\right). \end{aligned}$$

Plugging $V_1^{-1}(-(Cx_2+D)) = \frac{-(Cx_2+D)-B}{A}$, $V_2^{-1}(-(Ax_1+B)) = \frac{-(Ax_1+B)-D}{C}$, and collecting terms gives us

$$\begin{aligned} (\frac{-C}{A} + \frac{3}{2}C)x_2 - \frac{B+D}{A} &= \frac{1}{2}Cu_2 - D \qquad (11) \\ (\frac{-A}{C} + \frac{3}{2}A)x_1 - \frac{B+D}{C} &= \frac{1}{2}Au_1 - B. \end{aligned}$$

This system of equations must hold for all values of x_1 and x_2, which requires that $-\frac{C}{A} + \frac{3}{2}C = 0 \Rightarrow A = \frac{2}{3}$ and $-\frac{A}{C} + \frac{3}{2}A = 0 \Rightarrow C = \frac{2}{3}$. Plugging $A = \frac{2}{3}$ and $C = \frac{2}{3}$ into the system of equations (11) obtains

$$\begin{aligned} -(B+D) &= \frac{2}{9}u_2 - \frac{2}{3}D \\ -(B+D) &= \frac{2}{9}u_1 - \frac{2}{3}B \end{aligned}$$

Solving this system of equation gives us $D = -\frac{1}{4}u_1 + \frac{1}{12}u_2$, $B = \frac{1}{12}u_1 - \frac{1}{4}u_2$. The optimal announcements of the controlling shareholders as a function of their valuations are then

$$\begin{aligned} V_1(x_1) &= \frac{2}{3}x_1 + \frac{1}{12}u_1 - \frac{1}{4}u_2, \\ V_2(x_2) &= \frac{2}{3}x_2 + \frac{1}{12}u_2 - \frac{1}{4}u_1. \end{aligned}$$

From above, $V_1(x_1)+V_2(x_2) \geq 0$ is equivalent to $\frac{2}{3}x_1 + \frac{1}{12}u_1 - \frac{1}{4}u_2 + \frac{2}{3}x_2 + \frac{1}{12}u_2 - \frac{1}{4}u_1 \geq 0$, which implies $x_1 + x_2 \geq \frac{1}{4}(u_1+u_2)$. Plugging $x_i = b_i + \alpha_i y$ and $u_i = s_i + \frac{\epsilon}{2} + \alpha_i y$ into this last inequality and defining $\alpha = \alpha_1 + \alpha_2$ yields $b_1 + b_2 + \alpha y \geq s_1 + s_2 + \epsilon + \alpha y$.

We now show that $b_1 + b_2 + \alpha y \geq s_1 + s_2 + \epsilon + \alpha y$ characterizes the investment decision in the boundaries as well. If, for instance, x_2 is large enough to allow for the investment regardless of the announcement of the initial shareholder, Lemma 1 shows that $V_2 = V_2(x_2^\star)$ for $x_2 \geq x_2^\star$, where $x_2^\star$ solves $V_1(l_1) + V_2(x_2^\star) = 0$. Thus, $V_1(x_1) + V_2(x_2) \geq V_1(x_1) + V(x_2^\star) \geq 0 \Rightarrow V_1(x_1) + V_2(x_2) \geq 0 \Rightarrow b_1 + b_2 + \alpha_2 y \geq s_1 + s_2 + \epsilon + \alpha y$. Conversely, $V_1(x_1) + V_2(x_2) < 0 \Rightarrow V_1(x_1) + V(x_2^\star) < 0$, which is not consistent with the assumption that the investment will happen for $x_2 \geq x_2^\star$ with probability 1. Therefore, investing if and only if $b_1 + b_2 + \alpha_2 y \geq s_1 + s_2 + \epsilon + \alpha y$ is optimal when some realization of x_2 implies the undertaking of the project regardless of the realization of x_1. The same argument can be used to show that $b_1 + b_2 + \alpha_2 y \geq s_1 + s_2 + \epsilon + \alpha y$ characterizes the optimal investment rule when a large x_1 implies the undertaking of the project regardless of x_2. Finally, Lemma 1 shows that $V_1(x_1)$ and $V_2(x_2)$ are optimal announcements when x_1 and x_2 are such that the probability that the project will be undertaken is zero. Moreover, $V_1(x_1) + V_2(x_2) < 0$ in these cases. Hence, the investment rule $b_1 + b_2 + \alpha y \geq s_1 + s_2 + \epsilon + \alpha y$ still applies.

□

Proof of Proposition 3

We show that sharing control increases value for $\Pi \to 1$ when the control stake under shared control is equal to the optimal equity stake of a single controlling shareholder, i.e., $\alpha_1 + \alpha_2 = \alpha_1^\star = \alpha^\star$, where α_i is the equity stake of controlling shareholder i under shared control, and $\alpha_1^\star$ is the optimal equity stake of a single controlling shareholder. This suffices to prove the proposition because allowing the controlling shareholders choose a different control stake can only increase the gains of sharing control.

Let $\mathcal{I}_1 = \{(y,b) : b_1 + b_2 + \alpha^\star y \geq 0\}$ be the set of projects (payoffs) that a single controlling shareholder will undertake and $\mathcal{I}_2 = \{(y,b) : b_1 + b_2 + \alpha^\star y \geq \frac{1}{3}(\epsilon - \sum \epsilon_i)\}$ be the set of projects that will be undertaken under shared control. Given the probability Π that the project is inefficient, the gain (or loss) of sharing control is then $G(\Pi) = E[(y+b)(\mathcal{X}_{\mathcal{I}_2} - \mathcal{X}_{\mathcal{I}_1})]$. Note that since $\frac{1}{3}(\epsilon - \sum \epsilon_i)$ is always non-negative, $\mathcal{X}_{\mathcal{I}_2} - \mathcal{X}_{\mathcal{I}_1} = -1$ if $0 \leq b + \alpha^\star y < \frac{1}{3}(\epsilon - \epsilon_1 - \epsilon_2)$, and $\mathcal{X}_{\mathcal{I}_2} - \mathcal{X}_{\mathcal{I}_1} = 0$ otherwise. Therefore, sharing control is efficient if and only if $G(\Pi) \geq 0$.

Defining $\mathcal{U} = \{(y,b) : y + b > 0 \text{ and } 0 \leq b + \alpha^* y < \frac{1}{3}(\epsilon - \sum \epsilon_i)\}$ as the set of payoffs such that shared control leads to underinvestment, and $\mathcal{O} = \{(y,b) : y + b \leq 0 \text{ and } 0 \leq b + \alpha^* y < \frac{1}{3}(\epsilon - \sum \epsilon_i)\}$ as the set where shared control prevents overinvestment, we can write the gain of sharing control as

$$G(\Pi) = -E_\Pi[y + b|\mathcal{O}]P_\Pi[\mathcal{O}] - E_\Pi[y + b|\mathcal{U}]P_\Pi[\mathcal{U}],$$

where $E_\Pi[\cdot|\mathcal{A}]$ is the expectation conditional on being in the set $\mathcal{A}$ using the conditional distribution of (b, y) that yields the probability Π that the project is inefficient, and $P_\Pi(\mathcal{A})$ denotes the probability that the payoffs belong to $\mathcal{A}$. Note that, by construction of the sets $\mathcal{O}$ and $\mathcal{U}$, both $EO = -E_\Pi[y + b|\mathcal{O}] > 0$ and $EU = -E_\Pi[y + b|\mathcal{U}] < 0$ do not depend on Π because changes in Π affect only the probability that $b+y > 0$ or $b+y \leq 0$. Hence, conditioned on $\mathcal{O}$ or $\mathcal{U}$, changes in Π are irrelevant. We can thus write

$$G(\Pi) = EO \cdot P_\Pi[\mathcal{O}] + EU \cdot P_\Pi[\mathcal{U}].$$

But since $P_\Pi[\mathcal{O}]$ is increasing in Π (overinvestment becomes a more likely problem) and $P_\Pi[\mathcal{U}]$ is decreasing in Π, we conclude that $G(\Pi)$ is monotonically increasing in Π. Since $P_\Pi[\mathcal{U}] \to 0$

when Π is close to 1, monotonicity then implies that $G(\Pi) \geq 0$ for $\Pi \geq \hat{\Pi}$ and $\hat{\Pi}$ sufficiently close to 1. Thus, shared control dominates a structure with single-controlling shareholder for all $\Pi \geq \hat{\Pi}$.

□

Proof of Proposition 4

In an ownership structure with a single controlling shareholder, a larger investment requirement implies a larger equity sale to minority shareholders. The larger minority stake increases the incentives to distort the investment policy, leading to larger efficiency costs and a lower firm value. Therefore, a large financing requirement reduces firm value if control is not shared.

In contrast, firm value does not depend on the investment requirement I under shared control. To see this, let $\alpha_1 + \alpha_2$ be the optimal controlling stake given I and the presence of multiple controlling shareholders. Consider now an increase of the investment requirement from $I' > I$. The initial shareholder can finance I' without changing the controlling stake: simply sell more of his/her own shares to the second controlling shareholder. Inspection of the investment rule under shared control (equation (6)), reveals that the decision of undertaking the project depends only on the aggregate control stake, $\alpha_1 + \alpha_2$. Hence, if a controlling stake $\alpha_1 + \alpha_2$ is optimal for investment requirement I, then it must remain optimal for an investment requirement $I' > I$. It then follows that, contrary to firms with a single controlling shareholder, the level of financing requirement does not affect the value of firms with shared control.

As the financing requirement increases, the gains of sharing control vis-à-vis an ownership structure increases, making it easier for sharing control to increase value for any probability Π that the project is inefficient.

□

Proof of Proposition 5

Let the control stake under shared control be $\alpha_1 + \alpha_2 = 1$, which implies that the initial entrepreneur finances all the investment needs by selling shares to another controlling shareholder. Given this control stake, we show that the firm's value under shared control converges to the first best if Π is close to 1, while the firm's value cannot reach the first best with a single controlling shareholder.

From Proposition 2, controlling shareholders will invest only if $b+(\alpha_1+\alpha_2)y \geq \frac{1}{3}(\epsilon - \sum \epsilon_i) > 0$. For $\alpha_1 + \alpha_2 > 0$, the investment rule collapses to $b + y \geq \frac{1}{3}(\epsilon - \sum \epsilon_i) > 0$. It then follows that the only type of inefficiency that shared control may imply is underinvestment, which happens if $0 < b + y < \frac{1}{3}(\epsilon - \sum \epsilon_i)$. But if Π is close to 1, the probability that $y + b > 0$ goes to zero, and thus the ownership structure with shared control converges to the first best.

On the other hand, all ownership structures with a single controlling shareholder (with or without a monitor) do not approach the first best, as Π approaches 1. To see this, suppose that the optimal equity stake of a single controlling shareholder is $\alpha_1^\star < 1$ and that there is no monitor. The single controlling shareholder will invest if and only if $\alpha_1^\star y + b > 0$. The condition $Prob[y + b < 0, \alpha y + b > 0] > 0$ for any $\alpha \in [0, 1)$ then assures that there will be overinvestment with positive probability even if $\Pi = Prob[y + b < 0] \to 1$. Allow now for monitoring. Then the monitor may avoid overinvestment when $y + b < 0$ and $\alpha_1^\star y + b > 0$. However, excessive monitoring will result if $y + b < 0$ and $y > 0$, which, by assumption of the Proposition, is an event with positive probability for any Π. Therefore, we conclude that any ownership structure with a single controlling shareholder cannot reach the first best when Π is close to 1.

□

Proof of Proposition 6

Assume by absurd that, for any (b, y), there exists a controlling shareholder $i(b, y)$ who can successfully acquire full control paying $\{t_j(b, y)\}_{j \neq i(b,y)}$ to the other controlling shareholders. Note that we allow the payments to be contingent on the actual private benefits of all controlling shareholders, ignoring the signals. This follows the Revelation Principle, which allows us to restrict attention to direct mechanisms. As the single controlling shareholder, she would internalize all of the private benefits, investing if and only if $b+\alpha y > 0$, where $\alpha \equiv \sum_{i=1}^{2} \alpha_i$. If so, the outcome of the sale can be replicated by a direct mechanism that sets $x(b, y) = 1$ if and only if $b + \alpha y > 0$, with transfers $t_j(b, y)$ for $j \neq i(b, y)$, and $t_i(b, y) = -t_j(b, y)$. This direct mechanism is ex-post efficient, which, as we show next is not possible under the assumptions that, after the signals realize, a controlling shareholder's posterior on the private benefits of the other controlling shareholder is independent of her own private benefits.

By the Revelation Principle, a direct mechanism $(x(.), t(.))$ describes the outcome of the controlling shareholders' bargaining problem if it induces truthful announcement of the project's payoffs and provides incentives for both controlling shareholders to participate in the mechanism. To characterize these two constraints, let $X_i(y, b_i) = E_j[x(y, b_i, b_j)]$ be the expected probability that the project will be undertaken conditioned on y and controlling shareholder i announcing b_i (the expectation is taken with respect to b_j using the beliefs of controlling shareholder i). Likewise, $T_i(y, b_i) = E_j[t_i(y, b_i, b_j)]$ is the expected net transfer to shareholder i given b_i and y. Given $X_i(.)$ and $T_i(.)$, the expected utility of shareholder i conditioned on announcing $\hat{b}_i$ when his/her true private benefit is b_i is

$$U_i(y, \hat{b}_i, b_i) = v_i(y, b_i) X_i(y, \hat{b}_i) + T_i(y, \hat{b}_i).$$

Calling $U_i(y, b_i) \equiv U_i(y, b_i, b_i)$ the expected utility of truthfully announcing b_i, the truth-telling constraint (IC) requires that

$$(IC) \quad U_i(y, b_i) \geq U_i(y, \hat{b}_i, b_i) \quad \text{for any } i,\ b_i, \text{ and } \hat{b}_i.$$

The individual rationality constraint (IR) requires that shareholder i is at least as well off in the direct mechanism as in exercising his/her right to veto the project. Formally,

$$(IR) \quad U_i(y, b_i) \geq 0 \quad \text{for any } i \text{ and } b_i.$$

Finally, we require balanced transfers, that is, for any $\hat{\mathbf{b}}$:

$$(BB) \quad \sum_{i=1}^{2} t_i(y, \hat{\mathbf{b}}) = 0.$$

We thus say that a direct mechanism $(x(.), t(.))$ implements the possible outcomes of the bargaining game if and only if it satisfies the IR, the IC, and the BB constraints. The following Lemma characterizes the set of implementable direct mechanisms.

Lemma 2 *(Implementable investment policies) Let $x(.)$ be any investment policy, $F_i(b_j)$ be the controlling shareholder i's probability distribution (after the realization of the signals) on the private benefits of the other controlling shareholder, and $f_i(.)$ the density function. For any y, there is a vector of side payments $t(.)$ such that the direct mechanism $(x(.), t(.))$ satisfies the IC, IR, and the BB constraints if and only if $X_i(y, b_i)$ increases with b_i for each i and*

$$E\left[\sum_{i=1}^{2}\left(b_i + \alpha_i y - \frac{1 - F_i(b_i)}{f_i(b_i)}\right) x(y, \mathbf{b})|y\right] \geq 0. \tag{12}$$

Proof of the Lemma.

Standard arguments in the mechanism design literature prove that a direct mechanism $(x(.), t(.))$ satisfies the IC constraint if and only if, for any controlling shareholder i,

$$(IC-1) \quad U_i(y, b_i) = U_i(y, \underline{b}_i) + \int_{\underline{b}_i}^{b_i} X_i(y, b_i) db_i \tag{13}$$

$$(IC-2) \quad X_i(y, b_i) \geq X_i(y, b_i') \quad \text{for any } b_i \geq b_i'. \tag{14}$$

Plugging $U_i(y, b_i) = E_{-i}[x(y, b_i, b_{-i})v_i(y, b_i)] + T_i(y, b_i)$ into constraint (IC-1) obtains

$$E_{-i}[x(y, b_i, b_{-i})v_i(y, b_i)] + T_i(y, b_i) = U_i(y, \underline{b}_i) + \int_{\underline{b}_i}^{b_i} X_i(y, b_i) db_i. \tag{15}$$

Taking the expectation (over b_i) on equation (15) and summing over all i yields

$$E[\sum_{i=1}^{2} v_i(y, b_i)x(y, \mathbf{b})] = \sum_{i=1}^{2} U_i(y, \underline{b}_i) + \sum_{i=1}^{2} \int_{\underline{b}_i}^{\bar{b}_i} \int_{\underline{b}_i}^{b_i} X_i(y, b_i') db_i' f_i(b_i) db_i, \tag{16}$$

where we used that $\sum_{i=1}^{2} T_i(y, b_i) = 0$ (to see this, take the conditional expectation on Constraint (BB)). Integrating by parts $\int_{\underline{b}_i}^{\bar{b}_i} \int_{\underline{b}_i}^{b_i} X_i(y, b_i') db_i' f_i(b_i) db_i$ yields $\int_{\underline{b}_i}^{\bar{b}_i} (1 - F_i(b_i)) X_i(y, b_i) db_i$. This implies

$$E[\sum_{i=1}^{2} v_i(y, b_i)x(y, \mathbf{b})] = \sum_{i=1}^{2} U_i(y, \underline{b}_i) + \sum_{i=1}^{2} \int_{\underline{b}_i}^{\bar{b}_i} (\frac{1 - F_i(b_i)}{f_i(b_i)}) X_i(y, b_i) f_i(b_i) db_i. \tag{17}$$

The IR constraint implies $U_i(y, b_i) \geq 0$ for any b_i, hence $U_i(y, \underline{b}_i) \geq 0 \Rightarrow \sum_{i=1}^{2} U_i(y, \underline{b}_i) \geq 0$.

Using this inequality in equation (17) gives us

$$\int_{\underline{b}_1}^{\bar{b}_1}\int_{\underline{b}_2}^{\bar{b}_2}\{\sum_{i=1}^{2}[v_i(y,b_i)-(\frac{1-F_i(b_i)}{f_i(b_i)})]x(y,\mathbf{b})\}\prod_{k=1}^{2}f_k(b_k)db_k \geq 0.$$

□

From Lemma 2, for an ex-post efficient mechanism not to be implementable, it suffices to prove that

$$I = \sum b_i + \alpha_i y \geq 0 \int\int\sum_{i=1}^{2}\left(b_i+\alpha_i y - \frac{1-F_i(b_i)}{f_i(b_i)}\right)\prod_{k=1}^{2}f(b_k)db_k < 0. \tag{18}$$

Consider the following change of variables: $x_1 = -(b_1+\alpha_1 y), x_2 = b_2+\alpha_2 y$. Let the density and cumulative distribution of x_i be, respectively, f_i and F_i (by an abuse of notation) with support in the interval $[\underline{x}_i, \overline{x}_i]$ where $\underline{x}_1 = -\left(\overline{b}_1+\alpha_1 y\right)$, $\overline{x}_1 = -(\underline{b}_1+\alpha_1 y)$, $\underline{x}_2 = \underline{b}_2+\alpha_2 y$, and $\overline{x}_2 = \overline{b}_2+\alpha_2 y$. One can easily check that the assumption of the proposition implies $\underline{x}_2 < \overline{x}_1$ and $\overline{x}_2 < \underline{x}_1$. Using the formula for the integral with a transformation of variables we have that,

$$I = \int_{\underline{x}_2}^{\overline{x}_2}\int_{\underline{x}_1}^{\min\{x_2,\overline{x}_1\}}([x_2 - \frac{1-F_2(x_2)}{f_2(x_2)}] - [x_1+\frac{F_1(x_1)}{f_1(x_1)}])f_1(x_1)f_2(x_2)dx_1dx_2 \tag{19}$$

Myerson and Satterthwaite (1983) show that the above integral is negative under the assumptions of the Proposition. An ex-post efficient mechanism is thus not implementable, contradicting the initial assumption that the controlling group can be always dissolved.

□